Calendar No. 284

101ST CONGRESS *1st Session*	SENATE	REPORT 101-157

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, FISCAL YEAR 1990

Mr. HOLLINGS, from the Committee on Commerce, Science, and Transportation, submitted the following

REPORT

OF THE

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ON

S. 916

OCTOBER 3 (legislative day, SEPTEMBER 18), 1989.—Ordered to be printed

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, FISCAL YEAR 1990

OCTOBER 3 (legislative day, SEPTEMBER 18), 1989.—Ordered to be printed

Mr. HOLLINGS, from the Committee on Commerce, Science, and Transportation, submitted the following

REPORT

[To accompany S. 916]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 916) to authorize appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes, having considered the same, reports favorably thereon with an amendment in the nature of a substitute and recommends that the bill do pass.

PURPOSE OF THE BILL

The purpose of the bill is to authorize appropriations to the National Aeronautics and Space Administration (NASA) totaling $13,273,995,000 for fiscal year (FY) 1990 as follows:

	Budget request	Committee authorization
FY 1990:		
Research and development	$5,751,600,000	$5,786,600,000
Space flight, control and data communications	5,139,600,000	5,104,600,000
Construction of facilities	341,800,000	341,800,000
Research and program management	2,032,200,000	2,032,200,000
Inspector General	8,795,000	8,795,000

LEGISLATIVE HISTORY

On March 20, 1989, the Administration submitted its FY 1990–92 budget requests for NASA. On March 24, 1989, the Administration submitted its FY 1990 and FY 1991 budget requests for DOT's Office of Commercial Space Transportation. The Committee considered budget and related policy matters in hearings on February 9, March 8 and 16, April 4 and 11, and May 11 and 17. The hearing on May 17 focused on the requirements of the Office of Commercial Space Transportation. The Committee received testimony from the NASA Administrator and senior NASA officials associated with the major program elements, the Director of the Office of Commercial Space Transportation of the Department of Transportation (DOT), and the space science, space transportation, aeronautics, space station, educational and earth sciences communities.

On May 3, 1989, Senator Gore (for himself, and Senators Hollings, Danforth, and Pressler) introduced S. 916, a bill to authorize appropriations for NASA for FY 1990, FY 1991, and FY 1992. On May 3, 1989, Senator Gore (again with Senators Hollings, Danforth, and Pressler as cosponsors) introduced S. 920, a bill to authorize appropriations for FY 1990 and FY 1991 for DOT's Office of Commercial Space Transportation.

On June 20, 1989, the Committee met in open executive session and considered the budgets for NASA and the Office of Commercial Space Transportation. S. 916 was ordered reported without objection by the Committee, with an amendment in the nature of a substitute. The amendment includes language authorizing appropriations for DOT's Office of Commercial Space Transportation and for the National Space Council.

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION—NASA BUDGET SPREAD SHEET FOR FISCAL YEAR 1990

[In millions of dollars]

	Fiscal year 1989 operating plan	Fiscal year 1990 request	Proposed fiscal year 1990 Senate authorization	Comments
I. Research and Development	4,256.6	5,751.6	5,786.6	Reflects general reduction of $17m to R&D account.
1. Space Station	900.0	2,050.2	2,050.2	
2. Space Transportation Capability Development.	681.0	639.0	635.5	Assumes absorption of the $6m required for ACTS upper stage activities.
Spacelab	88.6	98.9		
Upper Stages	133.6	88.6		
Engineering & Tech. Base	160.6	189.8		
Payload Ops & Sup. Equip	64.7	81.1	−3.5	Delete funding for CDSF integration.
Advanced Programs	52.7	48.7		
Advanced Launch Systems	81.4	5.0		
Tethered Satellite System	26.4	19.9		
Orbital Maneuvering Vehicle	73.0	107.0		
3. Space Science	1,237.8	1,415.6	1.414.1	
A. Physics & Astronomy	742.1	894.5	894.5	Assumes absorption of $25m for Gravity Probe B.
Hubble Space Telescope Dev	104.9	67.0		
Gamma Ray Observatory Dev	50.9	26.7		
Global Geospace Science	64.4	112.3		

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION—NASA BUDGET SPREAD SHEET FOR FISCAL YEAR 1990—Continued

[In millions of dollars]

	Fiscal year 1989 operating plan	Fiscal year 1990 request	Proposed fiscal year 1990 Senate authorization	Comments
Advanced X-Ray Astrophysics Fac.	16.0	44.0	.....	
Payload & Instrument Dev	71.7	71.4	.....	
Shuttle/Spacelab Payload Mgt	69.7	86.1	.....	
Sp. Station Integrated Planning and Attached Payloads.	8.0	23.0	.....	
Explorer Development	82.1	93.2	.....	
Mission Operation & Data Analysis.	143.2	204.8	.....	
Research and Analysis	85.8	112.5	.....	
Suborbital Program	45.4	53.5	.....	
B. Life Sciences	79.1	124.2	122.7	General reduction of $1.5m.
C. Planetary Exploration	416.6	396.9	396.9	
Galileo Development	73.4	17.4	.....	
Magellan	43.1	—	.....	
Ulysses	10.3	14.5	.....	
Mars Observer	102.2	100.5	.....	
Mission Ops & Data Analysis	110.7	155.4	.....	
Research and Analysis	76.9	79.1	.....	
CRAF/Cassini	(1)	30.0	.....	Assumes new start status for the CRAF and Cassini Missions in FY 1990.
4. Space Applications	592.4	555.5	625.5	
A. Earth Science and Applications	404.7	410.1	420.1	
Geodynamics	32.9	38.0	.....	
Research and Analysis	106.0	124.8	.....	
Mission Operations & Data Analysis.	17.6	24.8	.....	
Earth Science Payload Instrument Dev.	46.4	42.3	.....	
Scatterometer	10.6	13.8	.....	
Earth Probe	(1)	0	10.0	Assumes new start for Earth Probe Program—+$10m for Total Ozone Mapping Spectrometer.
Upper Atmos. Res. Satellite (UARS).	85.2	73.9	.....	
Ocean Topography Experiment (TOPEX).	83.0	72.8	.....	
Airborne Science & Applications.	23.0	19.7	.....	
B. Materials Processing in Space	75.6	92.7	90.7	General reduction of $2m.
C. Communications	92.2	18.6	80.6	+$62m for ACTS
D. Information Systems	19.9	34.1	34.1	
5. Mission to Planet Earth—Earth Observing System.	(1)	24.2	24.2	Assumes FY 1990 New Start Status for Mission to Planet Earth—EOS (Administration assumes a FY 1991 New Start).
6. Commercial Programs	44.7	61.0	61.0	
Technology Utilization	16.5	22.7	.....	
Commercial Use of Space	28.2	38.3	.....	
7. Aeronautical Research and Technology	404.2	462.8	462.8	Includes $25m to initiate research for a high speed commercial aircraft. Absorb $10m to initiate a High Performance Computing Initiative.
Research & Technology Base	315.6	335.7	.....	
Systems Technology Program	88.6	127.1	.....	

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION—NASA BUDGET SPREAD SHEET FOR FISCAL YEAR 1990—Continued

[In millions of dollars]

	Fiscal year 1989 operating plan	Fiscal year 1990 request	Proposed fiscal year 1990 Senate authorization	Comments
8. Transatmospheric Research and Technology.	69.4	127.0	127.0	Requires submission of a new management plan within 60 days of enactment.
9. Space Research and Technology	285.9	328.1	325.1	General reductions to Pathfinder (−$7m) and In-Space Flight Experiments (−$6m).
10. Safety Reliability Maintainability and Quality Assurance.	22.4	23.3	23.3	
11. Tracking and Data Advanced Systems	18.8	19.9	19.9	
12. University Space Science and Technology Academic Program.	([1])	35.0	35.0	
II. Space Flight Control and Data Communications.	4,452.6	5,139.6	5,104.6	Reflects general reduction of $10m to SFC&DC account.
1. Space Shuttle Production/Operations Capability.	1,121.6	1,305.3	1,305.3	
Orbiter Operational Capability	281.8	237.0		
Launch & Mission Support	257.6	341.0		
Propulsion Systems	582.2	727.3		
2. Space Transportation Operations	2,385.7	2,732.2	2,732.2	
Flight Operations	687.7	772.6		
Flight Hardware	1,121.7	1,236.5		
Launch & Landing Operations	509.8	553.6		
Expendable Launch Vehicles	66.5	169.5		
3. Space Tracking & Data Acquisition	945.3	1,102.1	1,077.1	General reduction of $25m.
Space Network	483.9	582.3		
Ground Network	228.1	269.6		
Communications & Data Systems	233.3	250.2		
III. Construction of Facilities	281.7	341.8	341.8	
IV. Research and Program Management	1,906.6	2,032.2	2,032.2	
V. Inspector General	([1])	8.8	8.8	
Total NASA	[2] 10,897.5	13,274.0	13,274.0	

[1] New line items proposed for FY 1990.
[2] The FY 1989 Operating Plan includes $175 million in funds transferred from DOD to NASA for the Advanced Launch System and Space Shuttle Programs.

Summary of Major Provisions

For FY 1990, the Committee would authorize $13,273,995,000 for NASA, $4,392,000 for the Office of Commercial Space Transportation in DOT, $1,200,000 for the National Space Council. Of the amount authorized for NASA, $5,786,600,000 is authorized for research and development, $5,104,600,000 for space flight, control and data communications, $341,800,000 for construction of facilities, $2,032,200,000 for research and program management, and $8,795,000 for the activities of the Inspector General's Office.

A. TITLE I—NASA AUTHORIZATIONS

Space station

The reported bill provides full funding for the space station (known as "Space Station Freedom") in FY 1990, $2,050,200,000, as a signal of its commitment to the program and to the agreement

with our international partners. There is a concern with the pace of the space station program and with the inability of the Congress to provide adequate funds for this Presidential initiative. Unless the Congress is willing to recognize this program as a national priority and a budget priority, this Committee is concerned that this program will not be successfully implemented and that the United States will be forced to withdraw from this initiative.

The bill, as reported, does not include multi-year funding for the space station program, and it does not put a cap of $13,300,000,000 on the program as requested by the Administration. The Committee believes that it would be premature to put a cap on the space station program. As for multi-year funding, while there is a need for multi-year funding and Congress should provide full funding for the program and instruct NASA to manage the program to that cost and the associated schedule, the current budget situation makes full funding highly unlikely. Furthermore, multi-year authorizations may not add stability to the NASA budget or its programs, and multi-year authorizations without multi-year appropriations only serve to minimize the role of authorization committees in the annual budgetary and policy deliberations.

Space transportation capability

The Space Transportation Capability Development budget of $635,500,000 is $3,500,000 below the President's FY 1990 budget request. This reduction is for activities associated with the integration of the Commercially Developed Space Facility in the space shuttle. The reports of the National Research Council and the National Academy of Public Administration raising questions about this effort compel the Committee to defer any activities associated with the Commercially Developed Space Facility until a later date.

In addition, NASA will be instructed to absorb the cost of development of the upper stage for the Advanced Communications Technology Satellite (ACTS), $6,000,000, in this account. This should not adversely affect ongoing engineering activities nor should it affect adversely the spacelab or orbital maneuvering vehicle program activities.

Finally, the reported bill assumes authority to NASA to utilize funds transferred from the Department of Defense (DOD) for activities related to the Advanced Launch System program. It is estimated that DOD will transfer $100 million in FY 1990 to NASA for activities associated with this program.

Space science and applications

For Space Science activities, the substitute authorizes $1,414,100,000 in FY 1990—Physics and Astronomy, Life Sciences, and Planetary Exploration—which is $1,500,000 below the level requested in the President's budget request.

The $894,500,000 provided for Physics and Astronomy will support ongoing activities related to the deployment of the Hubble Space Telescope and the Gamma Ray Observatory and to the development of the Global Geospace Science spacecraft and Advanced X-Ray Astrophysics Facility (AXAF). This level of funding fully supports the FY 1990 request for mission operations and data analysis,

as well as research and analysis—the lifelines of the university research communities.

The $122,700,000 provided for Life Sciences in FY 1990 is a substantial increase over the FY 1989 baseline of $79,100,000. The substantial increase recommended for life science activities is consistent with the Committee's strong support of the space station program and development of an extended duration orbiter capability. If the United States is to increase substantially the level of manned activity in space, it is absolutely essential to have a robust life sciences program.

The $396,900,000 provided in FY 1990 for Planetary Exploration is the full amount requested by the Administration and gives new start status to the CRAF and Cassini missions. The new start approval for the CRAF and Cassini missions is contingent upon the establishment and implementation of a cost containment plan for these two missions. This is intended to ensure that NASA learns to manage projects to cost—the CRAF and Cassini missions offer a unique opportunity to test this new approach. The last space science mission done within cost was Voyager, launched in 1977. NASA has agreed that its inability to contain the cost of the CRAF and Cassini missions would result in the termination of the CRAF mission. NASA also has agreed that the cost containment plan would be based on an annualized basis, as well as a total project cost basis.

For Space Applications activities, the substitute authorizes $625,500,000—$420,100,000 for Earth Science and Applications, $90,700,000 for Materials Processing, $80,600,000 for Communications, and $34,100,000 for Information Systems.

For Earth Science and Applications, the reported bill provides $420,100,000 in FY 1990, $10,000,000 more than the President's request. The additional funding provided is to initiate the Earth Probe program as an FY 1990 new start and as a new line item in the NASA budget. The Earth Probe program will consist of a series of Explorer Class missions that will assess the level of ozone depletion, measure tropical rain forests, and monitor the oceans to understand better global change. The first mission to be funded is the Total Ozone Mapping Spectrometer (TOMS).

The reported bill authorizes $90,700,000 for Materials Processing in Space in FY 1990, a reduction of $2,000,000 from the President's request, and $34,100,000 for Information Systems, the same level as requested by the President. The bill also authorizes $80,600,000 for Communications in FY 1990, an increase of $62,000,000 above the President's budget request. The proposed increase in this latter account is to accommodate ACTS, which is strongly endorsed by the Committee. The Committee is concerned that the Administration has failed to fund the ACTS program for the fourth straight year despite Congressional support for this program, which is designed to ensure sustained U.S. leadership in communications technology.

Mission to Planet Earth

After months of review, the reported bill includes a new line item and instructions to NASA to initiate the Mission to Planet Earth, starting with the Earth Observing System (EOS) in FY 1990. The bill provides $24,200,000 for the initiative, which is the same

amount of funding that the Administration proposed for advanced technology definition activities for EOS in FY 1990. The initiation of a Mission to Planet Earth should be viewed as part of a comprehensive Global Change Research Program and as a high national priority and reflects the hope that the Administration will work with the Congress to expedite implementation of this program as proposed in this bill.

Commercial programs/safety and reliability

The reported bill authorizes $61,000,000 for Commercial Programs, $23,300,000 for Safety, Reliability, Maintainability, and Quality Assurance, and $19,900,000 for Tracking and Data Systems—the same levels as the President's request.

Aeronautical research and technology

The bill reported also includes $462,800,000 for Aeronautical Research and Technology, including $25,000,000 to initiate technology efforts related to the development of an environmentally and economically sound high speed commercial transport. This level of funding represents full support for the President's budget request, which assumes funding for a high speed commercial transport and reflects great concern by the Committee about the United States maintaining its lead in aeronautics and a positive balance of trade. However, if a high speed commercial aircraft is to be marketable, it must be environmentally sound. It must be able to meet all existing environmental standards and have enough margin to meet future standards. In light of the growing concern about the ozone layer and other environmental issues, the bill endorses NASA's proposal to focus its technology activities on the critical environmental challenges of a high speed commercial aircraft program.

In the same vein, the bill earmarks $10,000,000 for a high performance computer initiative that will accelerate the development and application of high performance computing technologies. This initiative should consist of the following program elements:

1. massively-parallel scalable testbed facilities;
2. algorithms and advanced software development; and
3. basic research infrastructure.

National aerospace plane

The bill reported authorizes $127,000,000 for Transatmospheric Research and Technology, the National Aerospace Plane (NASP) program, in FY 1990.

This level of funding represents full funding of the Administration's request for the NASA portion of this joint NASA-DOD program. The NASP program is calculated to develop the technologies in materials processing, propulsion systems, and other areas needed to produce a plane capable of taking off from a conventional runway, accelerating into low earth orbit, and then landing conventionally. The Committee sees NASP as crucial to our national effort to maintain and enhance competitiveness in the aerospace industry. Some in Congress fully expect NASP to lay the technological groundwork for major improvements in our military aircraft, an alternative launch system to the space shuttle, and eventually hypersonic commercial transports.

Since NASP is a joint program shared by NASA and DOD, DOD's participation is essential if the program is to produce two experimental aircraft, X-30s, for flight test purposes. In that connection, the Committee is aware of the continuing debate within the Administration about the appropriate role of DOD in the NASP program. However, the Committee wants to do its part in advancing aerospace technology by authorizing full funding for NASA's portion of the NASP program.

The authorization of funds in the reported bill is contingent upon the submission of a revised management plan, including goals, objectives, milestones, and proposed budgets, for the NASP program.

Space research and technology

The reported bill authorizes $325,100,000 for Space Research and Technology in FY 1990. This is $13,000,000 less than the President's budget request. While there continues to be strong support for NASA's efforts to enhance its technology base, due to the extreme budget pressures that exist and NASA's inability to obtain funding for ongoing programs strongly endorsed by the Committee, it is necessary to reduce the FY 1990 budget request for Space Research and Technology. This figure assumes that the Pathfinder Program would be funded at the FY 1989 level of $40 million and that the proposed new start for the In-Space Flight Experiments would be funded at $10,200,000 instead of the $16,200,000.

Academic programs

The reported bill includes a new line item for the University Space, Science and Technology Academic Programs, which reflects the full-funding Administration budget request for this program of $35,000,000. An amount of $5,000,000 is provided in this account for the National Space Grant College and Fellowship Program, which NASA initiated in FY 1989. NASA's efforts to broaden the participation of our Nation's educational institutions in the civil space program are very important.

General reduction/research and development account

To maintain a total level of spending for research and development activities of $5,786,600,000 in FY 1990, a general reduction of $17,000,000 has been applied against the account.

Space flight

The reported bill authorizes $5,104,600,000 for Space Flight, Control and Data Communications in FY 1990. This is $35,000,000 less than the President's budget request. This reduction represents a $25,000,000 general reduction to the Space Tracking and Data Acquisition account and a general reduction of $10,000,000 to the entire Space Flight Control and Data Communications Account. The amount provided for the Space Shuttle Productions and Operations Capability account, as well as the Space Transportation Operations account in FY 1990, should sustain operation of a safe and reliable space shuttle—NASA's highest priority.

The reported bill also provides $121,300,000 for the advanced solid rocket motor program in this account and gives NASA the authority to use the funds in the Space Shuttle Production and Oper-

ational Capability account as may be necessary to ensure operation of a safe and reliable space shuttle and development of an extended duration orbiter capability.

Construction of facilities

The reported bill fully authorizes the budget request for Construction of Facilities, $341,800,000, and provides additional legislative authority that permits NASA to secure private sector financing for the space station processing facility at the Kennedy Space Center, the neutral buoyancy laboratory at the Johnson Space Center, and the observational instrument laboratory at the Jet Propulsion Laboratory. The proposed Administration language for such service or lease contracts has been amended by the reported bill to require that such contracts result in net cost savings to NASA and are in the national interest. Some type of shared use agreement or equity investment on the part of the private sector should be required to make such proposals advantageous. While such projects should be funded by the Federal Government in the traditional manner, it is not feasible to provide additional funds for the such activities in the current budget environment.

Research and program management/inspector general

The reported bill authorizes $2,032,200,000 for research and program management in FY 1990. The value of NASA personnel to the success of the Nation's space program must be recognized, and this account reflects that view.

The reported bill includes $8,795,000 for the Office of the Inspector General in FY 1990, the level of funding requested by the President. This is the first time that this Office has been identified as a separate line item and as a separate appropriations account.

B. TITLE I—OTHER PROVISIONS

As previously indicated, Section 105 of the reported bill amends the National Aeronautics and Space Act to authorize the Administrator of NASA to enter into contracts, leases, or service agreements providing for private sector financing of the space station processing facility at the Kennedy Space Center, the neutral buoyancy laboratory at the Johnson Space Center, and the observational instrument laboratory at the Jet Propulsion Laboratory, provided that such activities are in the best interest of the government and result in net cost savings. If such contracts are entered into, the Administrator is allowed to use NASA's unobligated balances as a contingent liability in case the Government terminates one of these projects for its convenience. The Administration had requested a generic private financing authority, but the substitute reflects the view that a more limited authority as provided in Section 105, contingent upon specified conditions, is in the best interest of the civil space program.

As has been the case with prior year authorization bills, Section 106 of the reported bill instructs NASA to distribute research funds on a geographical basis where possible. Also, Section 107 directs that the space station may be used only for peaceful purposes.

Section 108 gives the Administrator of NASA the authority to use up to 5 percent of the funds provided for the Small Business Innovation Research Program for program management and promotional activities. This should make NASA's implementation of the program consistent with that of other Federal agencies and promote the transfer of technology to commercial applications.

Section 109 indicates that it is the sense of the Congress that the current prohibition on the export of U.S.-built satellites to the Soviet Union for launch on rockets of the Soviet Union shall continue to be the policy of the United States and that the policy shall be expanded to prohibit the export of U.S.-built satellites to other nations for launch on rockets of the Soviet Union.

C. TITLE II—OTHER AUTHORIZATIONS

The reported bill includes the FY 1990 Authorization for the Office of Commerical Space Transportation at DOT. The bill provides $4,392,000 for these activities, the full amount requested by the Administration.

D. TITLE III

The reported bill also authorizes the activities of the National Space Council, established by Public Law 100-685 (the FY 1989 NASA Authorization Act. For FY 1990, $1,200,000 has been provided for these activities, which reflects an assumed 50% reimbursement to Federal agencies for detailees assigned to the National Space Council.

Estimated Costs

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget Act of 1974, the Committee provides the following cost estimate, prepared by the Congressional Budget Office.

U.S. Congress,
Congressional Budget Office,
Washington, DC, July 26, 1989.

Hon. Ernest F. Hollings,
Chairman, Committee on Commerce, Science, and Transportation, U.S. Senate, Washington, DC.

Dear Mr. Chairman: The Congressional Budget Office has prepared the attached cost estimate for S. 916, the National Aeronautics and Space Administration Act, Fiscal Year 1990.

If you wish further details on this estimate, we will be pleased to provide them.

Sincerely,

Robert D. Reischauer,
Director.

CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

1. Bill number: S. 916.
2. Bill title: National Aeronautics and Space Administration Authorization Act, Fiscal Year 1990.

3. Bill status: As ordered reported by the Senate Committee on Commerce, Science, and Transportation, June 20, 1989.

4. Bill purpose: S. 916 would authorize appropriations totaling $13,279 million for fiscal year 1990; for this total, $13,274 million would be for the National Aeronautics and Space Administration (NASA), $4 million would be for the Office of Commercial Space Transportation (OCST) in the Department of Transportation, and $1 million would be for the National Space Council in the Executive Office of the President. Of the amount authorized for NASA programs, $5,787 million would be for research and development (including $2,050 million for the space station), $5,105 million would be for space flight control and data communications, $342 million would be for construction of facilities, $2,032 million would be for research and program management, and $8.8 million would be for the Office of the Inspector General.

S. 916 would also authorize NASA to enter into private financing arrangements such as leases or contracts for the development of three facilities—the Space Station Processing Facility, the Neutral Buoyancy Laboratory, and the Observational Instrument Laboratory—if such arrangements would result in a net cost savings to the government. S. 916 would effectively waive the requirements of the Anti-Deficiency Act (31. U.S.C. 1341), which would otherwise require NASA to obligate sufficient funds to cover the federal government's maximum current liability. Therefore, under S. 916, NASA would be authorized to enter into these financing arrangements without having funds provided in advance through appropriations. NASA would also be authorized to provide for the payment of termination liability in excess of appropriations for these projects; this liability would be paid only if any of the private financing arrangements are terminated by NASA for the convenience of the U.S. government.

5. Estimated cost to the Federal Government:

[By fiscal year, in millions of dollars]

	1990	1991	1992	1993	1994	
Direct spending (contract authority):						
Estimated budget authority		200				
Estimated outlays					20	20
Authorizations of appropriations:						
Authorization level		13,279				
Portion applied to debt reduction		−174				
Net authorization		13,105				
Estimated outlays		8,005	3,917	936	231	17
Total budget impact:						
Budget authority/authorization		13,479				
Portion applied to debt reduction		−174				
Net budget authority/authorization		13,305				
Estimated outlays		8,005	3,917	936	251	37

The costs of this bill would be in budget functions 250, 400, and 800.

Basis of estimate: The estimated direct spending authority would result from the private financing arrangements authorized by this

bill, which are discussed below. For the authorizations of appropriations, this estimate assumes that the full amounts authorized would be appropriated for fiscal year 1990, and that $174 million of the amount authorized for space flight, control, and data communications would be used to reduce outstanding debt associated with the tracking and data relay satellite program. The estimated outlays are based on historical spending patterns. Detailed estimates are shown in the table below.

Private financing arrangements: CBO estimates that the private financing arrangements authorized by this bill would provide roughly $200 million in budget authority (contract authority) to NASA in fiscal year 1990. This estimate of budget authority is preliminary because NASA has not yet decided whether to proceed with these arrangements or how these arrangements should be structured. Outlays from this budget authority would occur when the payments required by these agreements are made; we assume these payments would begin in 1993. As part of these agreements, NASA would be authorized to incur a contingent termination liability, requiring payments to the private parties if the government terminates the contracts for its convenience.

AUTHORIZATIONS PROVIDED BY S. 916 AND ESTIMATED OUTLAYS

[By fiscal year, in millions of dollars]

	1990	1991	1992	1993	1994
Research and development:					
Authorization level	5,787				
Estimated outlays	2,983	2,124	573	197	
Space flight, control, and data communications:					
Authorization level	5,105				
Portion applied to debt reduction	−174				
Net authorization	4,930				
Estimated outlays	3,337	1,307	286		
Construction of facilities:					
Authorization level	342				
Estimated outlays	22	191	77	34	17
Research and program management:					
Authorization level	2,032				
Estimated outlays	1,740	292			
Inspector general:					
Authorization level	9				
Estimated outlays	8	1			
Subtotal, NASA:					
Authorization level	13,274				
Portion applied to debt reduction	−174				
Net authorization	13,100				
Estimated outlays	8,000	3,916	936	231	17
Office of Commercial Space Transportation:					
Authorization level	4				
Estimated outlays	4	(1)			
National Space Council:					
Authorization level	1				
Estimated outlays	1	(1)			
Total, authorizations of appropriations:					
Authorization level	13,279				
Portion applied to debt reduction	−174				
Net authorization	13,105				
Estimated outlays	8,005	3,917	936	231	17

[1] Less than $500,000.

These transactions would ordinarily be subject to the requirements of the Anti-Deficiency Act. CBO believes, however, that the intention of S. 916 is to waive the Anti-Deficiency Act with regard to these private financing arrangements. Thus, NASA would be authorized to enter into the contracts for the financing of these facilities without having funding specifically provided in advance. This authority is called indefinite contract authority and is counted as budget authority.

Estimating the cost to the government of these private financing arrangements is difficult because their status is uncertain. NASA is still studying the merits of such arrangements and has not yet decided to seek private financing for these projects. Furthermore, S. 916 would not specify what types of agreements NASA should enter, though two general types have been discussed. Under the option presented in this estimate, a facility would be privately financed and owned, and then leased to the government, with the government obtaining ownership after expiration of the lease. Another option would allow private investors to both operate and finance construction of a government-owned facility.

Another uncertainty is whether NASA would be the sole user of these facilities. Any level of shared use would reduce the cost to the government, and, if a sufficient level of shared use existed, could result in a net cost savings relative to normal, Treasury-financed appropriations. Use of these private financing arrangements is generally more expensive than normal Treasury financed appropriations because private developers must borrow money at interest rates that are higher than the government's cost of borrowing. In preliminary analysis presented earlier this year, NASA showed that private demand accounting for 20 percent of the use of these facilities would be sufficient to generate a net cost savings on these projects. CBO cannot predict whether this level of private demand would exist.

The estimate presented here is intended to illustate the potential budget impact of the private financing arrangements authorized by this bill. The estimated budget authority equals the total of the stream of payments associated with these agreements. This estimate is based on assumptions that NASA would obtain a 10-year lease-purchase agreement for these facilities and that lease payments would begin in 1993.

CBO estimates that the construction costs for the three facilities would be about $128 million—$84 million for the Space Station Processing Facility, $30 million for Neutral Buoyancy Facility, and $14 million for the observational instruments laboratory—assuming these were built between 1990 and 1993. Under the assumed leasing arrangement, government outlays would be deferred until 1993 and spread over 10 years. CBO estimates that expenditures for the leases would be about $200 million and that the annual payments would be $20 million; this estimate includes the total cost of the facilities (about $128 million) plus financing costs of roughly $70 million.

Contingent termination liability. If these agreements are entered into, and if, as is likely, they specify termination payments, NASA

could not withdraw from any of them without providing for the payment of contingent termination liability. The contingent termination liability would secure the contractor's investment in the projects should the government choose to terminate the contract for its convenience. Under S. 916, NASA would be authorized to incur this contingent liability without having funding for that liability specifically providing in advance through appropriations. Nevertheless, we do not expect NASA to terminate this contract for the convenience of the government, and, therefore, we expect that it would never need to make a termination liability payment.

The amount of contingent liability incurred by the government at any time would be the amount required to pay off any contractual commitments outstanding at that time. Because NASA is still in the process of negotiating these arrangements, these amounts cannot be determined precisely at this time. Based on the estimated contract authority for these arrangements, CBO estimates that the maximum contingent termination liability associated with these arrangement would be less than $200 million. Should NASA choose to terminate any of these contracts, any payment of this liability would be drawn from the contract authority provided by the bill.

6. Estimated cost to State and local governments: None.

7. Estimate comparison: None.

8. Previous CBO estimate: None.

9. Estimate prepared by: Michael Sieverts.

10. Estimate approved by: James L. Blum, Assistant Director for Budget Analysis.

Regulatory Impact Statement

In accordance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee provides the following evaluation of the regulatory impact of the legislation.

Title I of this bill authorizes the appropriation of funds for the conduct of space and aeronautical research and development activities to carry out the policy and purpose of the National Aeronautics and Space Act of 1958. These activities are conducted in NASA laboratories, by NASA personnel and through contracts with industry, universities, and research institutions for research and development and for supporting scientific and technical services. The Committee has concluded that the nature of these activities is such that there is no significant regulatory effect on individuals and businesses and no effect on individual privacy. The reported bill reauthorizes these existing programs, and will have no additional regulatory, economic, paperwork, or privacy impact than the current programs.

Title II of the bill authorizes the appropriation of funds for the Office of Commercial Space Transportation at DOT. This office licenses and regulates the commercial expendable launch vehicle industry in order to protect the public health and safety and comply with existing U.S. treaty and international law obligations. This office was created to reduce the regulatory burden and paperwork requirements on the industry. The reported bill reauthorizes an existing program.

Title III of the bill authorizes the appropriations of funds for the National Space Council. The Council was created to provide a high level office dedicated to the formulation of space policy. A key role of the Council will be to assist in reducing the regulatory burden of commercial space firms trying to market their services to the U.S. Government and to compete in foreign markets.

Thus, authorization of the Office of Commercial Space Transportation, the National Space Council, and NASA programs in the reported bill is not expected to have any effect on individual privacy, should not have an unacceptable regulatory impact or impose an increased paperwork burden on the individuals or businesses who choose to participate, and will not have any significant additional economic impact than existing programs do.

Section-by-Section Analysis

TITLE I

Section 101-104—NASA

Overview

Section 101 (a), (b), (c), (d), and (e) authorizes $13,273,995,000 for NASA in FY 1990. These monies are distributed in five appropriations accounts:

Subsection (a), relating to research and development.—$5,786,600,000 for space station, space science and applications, space transportation capability development, commercial programs, aeronautics research and technology development, transatmospheric research and technology, and space research and technology, as well as other programs.

The major assumptions in this area are full funding ($2,050,200,000) and a strong endorsement of the space station program; restoration of funding for ACTS; initiation of a new space technology initiative—In-Space Flight Experiments—but at a reduced level of funding; approval of the new start requests for the CASSINI mission and for the CRAF mission; endorsement of a new aeronautics research and technology program for high speed commercial transportation; initiation of a new high performance computing program; continued support of the NASP program, contingent upon submission of a new program management plan; sustained support of the Gravity Probe B program; and approval of new start status for two programs at the initiation of the Committee—Earth Probe and Mission to Planet Earth (EOS).

Subsection (b), relating to space flight, control and data communications.—$5,104,600,000, including funds for space shuttle productions and operations capability ($1,305,300,000), space transportation operations ($2,732,200,000), and space tracking and data acquisition ($1,077,100,000).

The funds provided for these activities reflect this Committee's strong support of this program and its commitment to maintain a safe and reliable transportation system.

The reported bill reflects an endorsement of the initiation of the Advanced Solid Rocket Motor Program in this section. In this connection, the Committee also has agreed to permit private sector financing of the facility portion of this program. That authority has

been granted in a separate bill that the Committee has ordered reported, S. 663.

Subsection (c), relating to construction of facilities.—$341,800,000 for a variety of repair, rehabilitation, and new construction activities required for a robust civilian space program.

Subsection (d), relating to research and program management.—$2,032,200,000 for all civil service staff, maintenance of facilities, and support of research and development programs and contract activities, as well as technical and administrative support of research and development programs.

Subsection (e), relating to Inspector General.—$8,795,000 for the activities of the Office of the Inspector General of NASA. This is a new line item and a new appropriations account.

Section 101 (f), (g), (h), and (i) and Sections 102, 103 and 104 establish strict parameters for the Administrator of NASA concerning the amount of flexibility he or she has with construction of facilities activities, the transfer of funds from one account to another, and the use of funds for activities not approved by the Committee. These provisions are included in the NASA authorization bill every year.

Discussion of specific authorizations

During formulation of the FY 1990 NASA Authorization bill, the Committee decided to provide $13,274,000,000 for NASA in FY 1990. This is the same level of funding requested by the Administration.

This level of funding is substantially higher than the assumption of the Concurrent Resolution on the Budget for FY 1990, approximately $12,300,000,000, and higher than the FY 1990 VA-HUD-Independent Agencies Subcommittee Allocation for NASA under section 302(b) of the Congressional Budget Act of 1974. In the past, the Committee has been willing to propose reductions, when justifiable, to the President's budget request for NASA and to bear its share of the congressional deficit reduction burden. However, in FY 1990, reductions to the NASA budget request by the Office of Management and Budget (OMB) during preparation of the budget request were so severe, from $14,300,000,000 to $13,300,000,000, that the Committee believes further reductions to the President's request could have the following consequences:

1. slippage in the space station program of at least one year and a substantial cost increase to the program (at least $1,000,000);
2. termination of the NASP program;
3. further delay in the NASA plan to hire additional employees;
4. reduction to the scale and scope of the NASA technology programs; and
5. elimination of possible new starts in space science and aeronautics, including components of a Global Change Research Program or a High Speed Commercial Transport.

The bill reported by the Committee reflects the belief that such results are neither in the national interest nor the desire of the Congress.

The Committee notes that a constant theme of the NASA budget hearings this year was that the FY 1990 budget request was "marginal to submarginal." Based on the Committee's analysis, the FY 1990 run-out for the ongoing FY 1989 programs is $14,000,000,000 if no new starts are included. The President's FY 1990 budget request, however, is $13,300,000,000 with several new starts included. In FY 1990, the President requested an increase of $2,376,000,000 compared to the FY 1989 Operating Plan or roughly 22 percent. However, approximately 92 percent of the President's proposed increase went to ongoing programs, and the remaining 8 percent went to new starts such as the CRAF and Cassini Missions, the High Speed Commercial Transport, the In-Space Flight Experiment Program, and Voyager Interstellar.

The reported bill reflects the view that NASA must be funded adequately if we are intent upon implementing a balanced and robust civil space program. If the space program is a national priority, it must be a budget priority, and the level of funding proposed by the Committee, $13,300,000,000, should be provided. If the space program is not a budget priority and fewer funds are provided in FY 1990, the goals and objectives of the program must be reassessed, and if necessary, realigned.

During the course of the next few months, the Committee is well aware that the Congress and the Administration will be required to make some very difficult decisions about the future scope and direction of the civil space program. The bill reported by the Committee reflects the view that the civil space program should be maintained and further developed and that the necessary funds should be provided to support programs such as the space station, the NASP, the High Speed Commercial Transport, and a diversified space science and applications program. The Committee is aware that the NASA budget increase in FY 1990 represents one-third of the entire increase in outlays that can be accommodated under the Gramm-Rudman-Hollings targets for domestic discretionary spending and that this was a factor in the reduction proposed in the Concurrent Resolution on the Budget. However, as the Committee has already indicated, the space program that has been proposed by this and prior Administrations and endorsed by the Congress requires adequate and predictable funding if it is to be implemented. The civil space program cannot be carried out without adequate funding, and the level of funding prescribed in the Committee's bill is the "floor" for FY 1990, not the "ceiling."

A. RESEARCH AND DEVELOPMENT—$5,786,600,000

The Committee authorizes $5,786,600,000 for research and development activities in FY 1990. This is $35,000,000 more than the President's FY 1990 budget request, despite a general reduction of $17,000,000 to be applied to this program. The Committee has given NASA the authority to make this reduction at its discretion, which thus will affect the Committee's proposed funding levels for certain of NASA's research and development activities in FY 1990.

The objectives of the NASA program of research and development are to extend our knowledge of the Earth, its space environment, and the universe; to expand the technology for practical ap-

plications of space technology; to develop and improve manned and unmanned space vehicles; and to assure continued development of the long-term aeronautics and space research and technology necessary to accomplish national goals. These objectives are achieved through the following elements:

Space station.—A program to develop a U.S. space station to continue the Nation's leadership in space, and to provide for enhancement of science and applications programs and further the commercial utilization of space while stimulating advanced technologies.

Space transportation capability development.—A program to provide for the development and use of capabilities related to the Space Shuttle. The principal areas of activity in Space Transportation Capability Development are efforts related to the development and flight certification of the jointly developed U.S./Italy Tethered Satellite System; development of the Orbital Maneuvering Vehicle; development and operations of the Spacelab systems; the development and procurement of upper stages that place satellites in high altitude orbits; the engineering and technical base support at NASA centers; payload operations and support equipment; advanced launch system technology development and study activities; and advanced programs study and evaluation efforts.

Space science and applications.—A program using space systems, supported by ground-based and airborne observations: (1) to conduct a broad spectrum of scientific investigations to advance our knowledge of the Earth and its space environment, the Sun, the planets, interplanetary and interstellar space, the stars of our galaxy and the universe; and (2) to identify and develop the technology for the useful applications of space techniques in the areas of advanced communications satellite systems technology; materials processing research and experimentation; and remote sensing to acquire information which will assist in the solution of Earth resources and environmental problems.

Technology utilization.—A program that includes activities to accelerate the dissemination to both the public and the private sectors of advances achieved in NASA's research, technology, and development program.

Commercial use of space.—A program to increase private sector awareness of space opportunities and encourage increased industry investment and participation in high technology, space-based research and development.

Aeronautics and space technology.—A program to conduct the fundamental long-term research and to develop the discipline and systems technology required to maintain U.S. leadership in aeronautics and space.

Safety, reliability, maintainability, and quality assurance.—A program to enhance the safety and technical execution of NASA programs.

Tracking and data advanced system.—A program that includes activities to perform studies and provide for the development of systems and techniques leading to improved tracking and data program capabilities.

University space science and technology academic program.—A program that includes activities to support agency-wide university and minority university programs.

1. Space Station—$2,050,200,000

The Committee authorizes $2,050,200,000 for the Space Station Freedom (SSF) program. This is the same as the President's FY 1990 request. However, of the funds provided, $80,000,000 is authorized only for development of the flight telerobotic servicer (FTS). This is an increase of $65,000,000 when compared to the President's budget request for FTS. This augmentation for the FTS is required because private sector financing of this state of the art technology was not feasible.

Summary of FY 1990 funding levels

Development	$1,905,200,000
Flight telerobotic services	80,000,000
Operations	25,000,000
Transition definition	25,000,000
Orbital debris radar	15,000,000
Total Space Station	2,050,200,000

Development of the U.S. permanently manned Space Station, as directed by President Reagan, will add new momentum to the civil space program and is essential to preserving U.S. preeminence in science, technology and manned space flight. The SSF program gives us our first opportunity to gain direct experience in long-term human operations in space and knowledge essential to future space exploration. The Space Station will uniquely enhance the U.S. space science programs, further the commercial utilization of space, and stimulate the development and application of advanced technologies of national importance. It is also an avenue of cooperation with our allies, demonstrating the peaceful use of space for the benefit of all mankind.

The SSF will be unique because it will provide the United States with a permanently manned presence in space. It will be versatile because its capabilities will be remarkably diverse. This diversity is reflected in the Space Station's design, which features pressurized laboratories, accommodations for attached payloads, and free-flying unmanned platforms. This new national laboratory, a research center in space, will stimulate new technologies, enhance industrial competitiveness, further commercial space enterprises, and add greatly to our storehouse of scientific knowledge. Perhaps the most significant feature of the Space Station, essential to its utility for science, commerce, and technology, is the continuing presence of its crews. Men and women will be aboard the Space Station base full-time. The potential of humans—their creativity—is unique and essential. The Space Station will be designed to exploit the human capabilities. The Space Station's microgravity environment, high levels of power, and extended time in orbit will enable scientists to make new discoveries in materials research and life sciences. The Space Station's substantive research capabilities include far more than its pressurized volume. Its free-flying platforms will enable truly synergistic studies of the Earth's atmosphere, land masses, and oceans—referred to as Earth system science. These activities

will complement the proposed Mission to Planet Earth which will help us to understand our environment and aid us in learning to conserve its precious resources. Moreover, the Space Station's external structure is designed to be a stable platform that will be available for mounting a number of specialized instruments and telescopes. Scientific instruments, whether in a laboratory or on a boom, require maintenance, upgrading, repair, and replacement. The Space Station will accommodate these servicing functions. The SSF will be designed to evolve, to be capable of growth in its capabilities, so that future needs and challenges can be met.

The SSF will be a multi-purpose, international facility. In 1984, President Reagan invited the full participation of other nations. During the ensuing definition phase, Canada, the member states of the European Space Agency (ESA), and Japan worked closely with the United States to define their participation. These parallel definition and preliminary design studies have resulted in the identification of the Space Station elements to be developed by our partners. Negotiations with these international partners for the development phase of the program were completed in the Fall of 1988. Agreements have been signed with the Canadian government for the development of a mobile servicing system, with the member countries of ESA for the inclusion of a pressurized attached module, a man-tended free flyer, and a polar platform, and with the Japanese government for the development of an attached laboratory module.

Space Station—Committee Comments

The Committee strongly endorses the development of a permanently manned space station in cooperation with our allies. Therefore, the Committee has authorized funding at the level of the President's FY 1990 budget request for this program.

The Committee, however, is very concerned about the budget outlook for the space station program, as well as other science and technology programs funded in the domestic discretionary budget. Since funding for the space station program was cut in the FY 1988 Continuing Resolution (Public Law 100-202), it is apparent that, despite the broad base of support for the program, it is very difficult to get the necessary budget resources to implement the program.

The Committee has provided full funding of the space station program in FY 1990 to signal its strong endorsement of this program and to indicate that further reductions in the space station program budget are not possible without further delays in the deployment date and significant costs increases. The Committee believes that the Congress and the President must come to an agreement in FY 1990 that the space station program is a national priority and a budget priority so that the necessary funds will be provided to keep this program on schedule.

To further complicate this decision, our foreign partners have already made significant investments in their portion of the program—an estimated $567 million. Our foreign partners' participation in the space station program is estimated to be valued at between $7 and $8 billion.

The Committee is convinced that working together with our partners on the permanently manned civil space station will further expand cooperation through the establishment of a long-term and beneficial relationship and will further promote cooperation in the exploration of and peaceful use of outer space. The Committee also is convinced that the termination of the space station program or the introduction of significant delays in this program could adversely affect U.S. foreign policy and could preclude future cooperative activities. In that regard, the Committee notes that, to our foreign partners—Japan, Canada, and the member nations of the ESA—the Space Station Intergovernmental Agreement has the standing of a treaty.

The Committee has provided $80,000,000 in the space station budget for the FTS. The bill requires NASA to absorb these funds in FY 1990 because OMB's "assumed" private sector financing of this activity proved infeasible. In the FY 1991 budget submission, the Committee expects to see a separate line item for the FTS and to see additional funds provided for this account—it should not be absorbed by the space station program.

The Committee has decided not to include multi-year funding for the space station program or to impose a cap of $13,300,000,000 on the program as requested by the Administration. The Committee's reluctance to take these two steps is a function of the budgetary instability that confronts the program. While the Committee endorses the concept of multi-year authorizations and appropriations for large-scale programs to add stability to the program and to ensure better management and cost containment, the Committee does not see the necessary conditions of stability in the case of the space station program. The Committee is hopeful that the current situation will be remedied and that these elements of the program can be reassessed in FY 1991.

As stated in section 107 of the bill, the Committee maintains its belief that the space station is a facility that should be used for peaceful purposes in accordance with international law. Accordingly, the Committee has incorporated language in the FY 1990 bill which affirms this position. The same language was included in the FY 1985, 1986, 1987, 1988, and 1989 Senate NASA authorization bills and restates Article IV of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Celestial Bodies. Pursuant to this standard, DOD is perceived to be a user of the space station, and it is recognized that DOD may conduct research and development activities on the space station facilities.

The Committee also notes that it is working with NASA, the Department of State, and the Senate Judiciary Committee to finalize language for a space patent legislative initiative. This legislation is required to implement the Space Station Intergovernmental Agreement.

2. Space Transportation Capability Development—$635,500,000

The Committee authorizes $635,500,000 for Space Transportation Capability Development in FY 1990. This is $3,500,000 below the President's budget request.

The reported bill also includes language that (1) instructs NASA to absorb the $6,000,000 cost of the upper stage for the ACTS and (2) gives NASA the authority to use funds transferred from DOD for propulsion activities related to the Advanced Launch System program.

Summary of FY 1990 funding levels

Spacelab	$98,900,000
Upper stages	88,600,000
Engineering and technical base	189,800,000
Payload operations and support equipment	77,600,000
Advanced programs	48,700,000
Advanced launch systems	5,000,000
Tethered satellite system	19,900,000
Orbital maneuvering vehicle	107,000,000
Total	[1] 635,500,000

[1] Within this amount, NASA must absorb the costs of the ACTS upper stage ($6,000,000).

The principal areas of activity in Space Transportation Capability Development include the Spacelab; the Upper Stages required to place satellites in high altitude orbits; the Engineering and Technical Base support at the manned space flight centers; Payload Operations and Support Equipment for accommodating NASA payloads; Advanced Programs Study and Evaluation efforts; Advanced Launch Systems efforts; the design and development of the U.S./Italian Tethered Satellite System; and the development and first flight of the Orbital Maneuvering Vehicle.

Space Transportation Capability Development—Committee Comments

For this authorization, the Committee has reduced the President's budget request by $3,500,000, the amount to cover integration costs associated with the Commercially Developed Space Facility. Based on the findings of the National Research Council and National Academy of Public Administration reports on the Commercially Developed Space Facility, the Committee believes these activities should not be funded at this time.

The Committee also has instructed NASA to absorb the cost of the Transfer Orbit Stage (TOS), the upper stage for the ACTS. The Committee's estimate of this activity is $6,000,000 in FY 1990.

The Committee has provided legislative authority for NASA to use funds transferred from DOD for propulsion activities related to the development of the Advanced Launch System. This authority is similar to the authority contained in the FY 1989 NASA Authorization Act (Public Law 100–685). The Committee understands that $100,000,000 will be transferred from DOD to NASA for these activities in FY 1990.

The Committee notes the substantial progress being made on the Orbital Maneuvering Vehicle. It also expects the Spacelab program to remain a high NASA priority.

The Committee strongly endorses the development of an extended duration orbiter for the space shuttle and expects NASA to keep it fully informed of efforts to finance privately this hardware. If for any reason the privatization initiatives are not successful, the Committee has given NASA the authority to use such sums as may

be necessary to ensure the availability of an extended duration orbiter in the space shuttle production and operational capability account.

The Committee is well aware of the current debate on the requirements for a crew emergency rescue vehicle. On this particular issue, the Committee agrees with NASA and the NASA Aerospace Safety Advisory Panel that a crew rescue vehicle or lifeboat should be an essential part of the space station's design.

3. Physics and Astronomy—$894,500,000

The Committee authorizes $894,500,000 for Physics and Astronomy in FY 1990. This is the same as the President's budget request. The Committee, however, has instructed NASA to absorb the cost of the Gravity Probe B Mission, $25,000,000, in that allocation.

Summary of FY 1990 Funding Levels

Hubble space telescope development	$67,000,000
Gamma ray observatory development	26,700,000
Global geospace science	112,300,000
Advanced x-ray astrophysics facility development (AXAF)	44,000,000
Payload and instrument development	71,400,000
Shuttle/Spacelab payload mission management and integration	86,100,000
Space station intergrated planning and attached payloads	23,000,000
Explorer development	93,200,000
Mission operation and data analysis	204,800,000
Research and analysis	112,500,000
Suborbital program	53,500,000
Total	[1] 894,500,000

[1] Within this amount, NASA must absorb the cost of the Gravity Probe B Mission ($25,000,000).

The goals of the Physics and Astronomy program are to increase our understanding of the origin and evolution of the universe, the fundamental laws of physics, and the formation of stars and planets. Objects studied by the Astrophysics program include distant galaxies and galactic clusters, as well as stars and other structures in nearby galaxies and the interstellar medium in our galaxy. Unusual and exotic phenomena—such as quasars, neutron stars, pulsars, and black holes—are of particular interest to the Astrophysics program, and are the target of many ground-based and space-based research programs. In the Space Physics program, intensive study of our own Sun, with its multitude of time-varying phenomena, provides key answers to a vast range of questions requiring compehensive research into polar-terrestrial processes and the physics and coupling between the solar wind, magnetosphere, and atmosphere.

The objectives of the Physics and Astronomy program are accomplished with a mixture of large, complex, free-flying space missions, less complex Explorer spacecraft, Shuttle/Spacelab flights, and suborbital opportunities. In the future, the Space Station will act as a platform for attached payloads and potentially as a servicing point for major free-flying observatories which require assembly, maintenance, and refurbishment in orbit. Space-based research allows observations in wavelength regions such as the infrared or the ultraviolet which cannot be carried out on the ground due to the obscuring effects of the atmosphere. Also, observations in the visible light

region are vastly improved when conducted above the atmosphere. The entire program rests on a solid basis of supporting research and technology, data analysis, and theory.

Research teams involved in this program are located at universities, industrial laboratories, NASA field centers, and other government laboratories. The scientific information obtained and the technology developed in this program are made available to the scientific communities and the general public for application to the advancement of scientific knowledge, education, and technology.

Physics and Astronomy—Committee Comments

Within the authorization level for Physics and Astronomy NASA is instructed to absorb the cost of the Gravity Probe B mission that was terminated during NASA readjustments of the OMB passback. The Gravity Probe B space shuttle experiment, which will test Einstein's general theory of relativity, requires $25,000,000 in FY 1990.

The Gravity Probe B mission, started in 1961 and funded by NASA since 1963, is a unique university/industry initiative that is both a scientific and management experiment. To date, the program has spent $40,000,000 or 35 percent of the total estimated cost of a space shuttle flight experiment, including instrument development. There is Committee support for this mission and its 1994 space shuttle flight.

The Committee is pleased to note that several Physics and Astronomy missions are scheduled for flight in the next 18 months, including the Cosmic Background Explorer (November, 1989), the Hubble Space Telescope (March, 1990) and the Gamma Ray Observatory (June, 1990). The return of the space shuttle to flight status and the implementation of the mixed fleet concept represent significant opportunities for NASA's space science programs. Furthermore, the ongoing activities in the Explorer program, the Global Geospace Science program, and the AXAF point to future accomplishments in the Physics and Astronomy program area. Successful implementation of these missions should help ensure U.S. leadership in physics and astronomy.

However, as noted below in the Planetary section of the Committee report, there are still concerns. Foremost on the Committee's list is a concern about recurring cost increases in the NASA space science programs (concerns which were documented in a series of General Operating Office (GAO) reports compiled at the request of the Committee). The fact that the total estimated cost of the AXAF mission has increased 19 percent in the first year of the project is evidence of the magnitude of the problem. Either NASA must implement cost containment procedures, or the Committee will be forced (1) to reassess the status of programs that experience significant cost overruns and/or (2) to restrict any additional new starts.

The Committee, therefore, directs NASA's Office of Space Science and Applications to submit recommendations on cost containment procedures for its projects in conjunction with the FY 1991 budget. Successful implementation of these procedures will be an important management tool for NASA and will help ensure the availability of funds for additional space science activities.

The Committee notes that it continues to endorse the strategic planning efforts of the Office of Space Science and Applications for Physics and Astronomy and directs NASA to include Gravity Probe B in the plan.

4. Life Sciences—$122,700,000

The Committee authorizes $122,700,000 for Life Sciences in FY 1990. This is $1,500,000 less than the President's budget request.

Summary of FY 1990 funding levels

Human space flight and systems engineering	$42,800,000
Space biological sciences	27,600,000
Life sciences flight experiments	
Research and analysis	53,800,000
Total	[1] 122,700,000

[1] Total reflects a general reduction of $1,500,000 to be applied to NASA's discretion.

The goals of the Space Life Sciences program are to advance knowledge in all areas of space life sciences and to develop medical and biological systems which enable human habitation in space. Results from the research program are applied to: the immediate needs of maintaining astronaut health and productivity; understanding of the response of biological mechanisms to weightlessness; the design of controlled ecological life support systems; understanding of the origin, evolution, and distribution of life in the universe; and understanding of the biosphere of the planet Earth.

Continuing support of the Space Life Sciences program is essential: to understand the basic biological mechanisms of gravitational responsivity; to evolve the critical technologies necessary to enable long-term piloted space flight; and to develop the capability to sustain a permanent manned presence in space. The research program includes ground-based and space research efforts which are mutually supportive and integrated, and the study of fundamental biological processes and space-related medical problems through a variety of disciplines and techniques.

Life Sciences—Committee Comments

The Committee strongly endorses NASA's proposed increase for Life Sciences in FY 1990 over previous years' levels. If the United States is committed to long duration space flight for man, it is essential that NASA have a comprehensive life sciences program. This theme was highlighted in the Robbins Report, "Exploring the Living Universe," and in numerous other reports and journals.

The FY 1990 Life Sciences program proposed by NASA is an effort to establish the priority status of this program element, and this effort is endorsed by the Committee. In this regard, the Committee notes initiation of the 1.8m centrifuge, the Life Sciences Centers of Research, and the Space Biology Initiative. The availability of state of the art facilities and instruments to conduct research and the concentration of resources on interdisciplinary centers of research should greatly enhance the standing and capability of the NASA Life Sciences program.

The Committee also is pleased to see that NASA has initiated the extended duration orbiter medical program to ensure pilot and

crew performance and proficiency during extended space shuttle missions.

Finally, the Committee acknowledges NASA's role in the creation of its Medical Bridge between the United States and the Soviet Union in the aftermath of the Armenian earthquake. Vital medical information was provided via satellite to on-site medical teams and resulted in the application of life-saving medical care. This satellite link also was used in the aftermath of the recent train disaster in the Soviet Union.

The general reduction imposed on this account by the Committee is done so without prejudice by the Committee as to where the reduction should be made.

5. Planetary Exploration—$396,900,000

The Committee authorizes $396,900,000 for Planetary Exploration in FY 1990. This is the same as the President's budget request.

Summary of FY 1990 funding levels

Galileo development	$17,400,000
Magellan	
Ulysses	14,500,000
Mars observer	100,500,000
Comet rendezvous asteroid flyby/Cassini	30,000,000
Mission operations and data analysis	155,400,000
Research and analysis	79,100,000
Total	396,900,000

The Planetary Exploration program encompasses the scientific exploration of the solar system including the planets and their satellites, comets and asteroids, and the interplanetary medium. The program objectives are: (1) to determine the nature of planets, comets, and asteroids as a means for understanding the origin and evolution of the solar system; (2) to understand better the Earth through comparative studies with the other planets; (3) to understand how the appearance of life in the solar system is related to the chemical history of the solar system; and (4) to provide a scientific basis for the future use of resources available in near-Earth space. Projects undertaken in the past have been highly successful based on a strategy that places a balanced emphasis on the Earth-like inner planets, the giant gaseous outer planets, and the smaller bodies (comets and asteroids). Missions to these bodies start at the level of reconnaissance to achieve a fundamental characterization of the bodies, and then proceed to levels of more detailed study.

The reconnaissance phase of inner planet exploration, which began in the 1960s, is now virtually completed, although we still know little about the nature of the planet Venus' surface. Mars has provided program focus because of its potential as a site of biological activity. The Viking landings in 1976 carried the exploration of Mars forward to a high level of scientific and technological achievement, thereby setting the stage for the next step of detailed study. Analyses of meteorites and the lunar rock samples returned by Apollo continue to be highly productive, producing new insights into the early history of the inner solar system and thus leading to a revision of our previous theoretical concepts. The Pioneer Venus mission is continuing to carry the study of the Earth's nearest

planetary neighbor and closest planetary analog beyond the reconnaissance stage to the point where we have now obtained a basic characterization of Venus' thick, massive atmosphere, as well as fundamental data about the formation of the planet.

The exploration of the giant outer planets began more recently. The Pioneer-10 and -11 missions to Jupiter in 1973 and 1974 were followed by the Voyager-1 and -2 spacecraft encounters with Jupiter in 1979. Voyager-1 then encountered Saturn in November 1980, and Voyager-2 encountered Saturn in August 1981. The Voyager data on these planets, their satellites, and their rings have revolutionized our concepts about the formation and evolution of the solar system. Voyager-2 encountered Uranus in January 1986 and has provided our first look at this giant outer planet. Its trajectory has recently carried it to an encounter with the planet Neptune in August 1989. The Pioneer-10 and -11 and Voyager-1 spacecraft are on trajectories heading out of the solar system as they continue to return scientific data about the outer reaches of the solar system.

The successful launch of the Magellan mission to Venus in May 1989, combined with the schedule launch of the Galileo mission to Jupiter in October 1989, the Ulysses mission to the polar plane of the Sun in October 1990 (this is a joint U.S./ESA Mission), and the Mars Observer mission in September 1992 should firmly reestablish the leadership of the United States in planetary science.

Research and analysis activities will continue to maximize the scientific return from current missions and from such Earth-based activities as lunar sample and meteorite analysis, telescope observations, theoretical and laboratory studies, and instrument definition. This program strives for interdisciplinary coordination among various research groups and for the wide dissemination of scientific results. A close association is also maintained between the research programs and planning activities to define the scientific rationale and technology needed for future missions. The program also supports the growing involvement of U.S. scientists as participants on foreign-sponsored missions.

Planetary Exploration—Committee Comments

As noted above, the Committee is concerned about cost creep in the NASA space science and applications program, as well as about constrained budgets in the outyears due to Government-wide fiscal pressures. Therefore, during its assessment of the proposed new start status for the Comet Rendezvous and Asteroid Flyby mission (CRAF) and the Cassini mission to Saturn, the Committee decided that a cost containment plan had to be implemented by NASA if these missions were to be approved.

S. 916, as reported, authorizes $30,000,000 for the CRAF and Cassini missions if a cost containment plan is formulated for those missions and submitted to the Committee on Commerce, Science, and Transportation of the Senate, to the Committee on Science, Space, and Technology of the House, and to the Committees on Appropriations of the House and Senate. The Committee expects NASA to initiate formulation of this plan immediately. The Committee expects this plan to contain the annualized and total estimated cost of these two missions. Failure to stay within a set per-

centage of the plan's funding profile would result in the termination of the CRAF mission.

The Committee notes that both the CRAF and Cassini missions have very limited launch opportunities (CRAF must be launched before 1996 and Cassini before 1997) and varying degrees of foreign participation (ESA's contribution to the Cassini mission is estimated to be worth $200,000,000 and the West German contribution to the CRAF mission is estimated to be worth $50,000,000). Thus, any program delays could result in loss of launch opportunities for these missions. The Committee, therefore, expects NASA and the contractor teams to give these missions their serious attention.

The Committee also expects NASA to have a "firm" memorandum of agreement in place with the Air Force to ensure the availability of Titan IV's for the CRAF and Cassini missions and for the space station polar platforms. The Committee would like to be apprised of the availability of these launch vehicles and the status of an agreement with the Air Force as soon as possible.

In addition to the CRAF and Cassini missions, the Committee is pleased to see firm launch dates for the Galileo, Ulysses, and Mars Observer missions and notes the successful deployment of the Magellan mission to Venus in May of this year. The Nation's planetary program has been a source of great national pride and scientific inquiry. Perhaps the greatest tribute to this program and to the people in the NASA/contractor/university team was the recent Voyager encounter of the planet Neptune in August 1989. Voyager was launched in 1977 and since that time has encountered Jupiter, Saturn, and Uranus. It has been the source of significant scientific data and information and has helped establish a better understanding of the solar system.

Finally, the Committee continues to endorse the strategic planning efforts of the Office of Space Science and Applications for Planetary Exploration.

6. Space Applications—$625,500,000

The Committee authorizes $625,500,000 for Space Applications in FY 1990. This is $70,000,000 more than the President's budget request. Of this amount, $420,100,000 is for Earth Science and Applications, $90,700,000 is for Materials Processing, $80,600,000 is for Communications, and $34,100,000 is for Information Systems.

The $24,200,000 requested by the Administration for the Mission to Planet Earth, in particular the EOS, has been fully authorized in the reported bill but is highlighted as a separate line item by the Committee. This program will be discussed in the next section of this report. This adjustment has been reflected in the report's budget tables.

(a) Earth Science and Applications—$420,100,000

The Committee authorizes $420,100,000 for Earth Science and Applications in FY 1990. This is $10,000,000 more than the President's budget request. The increase is necessary to initiate the Earth Probe program in FY 1990, commencing with the TOMS mission. The Earth Probe program was recommended in a 1988 Space Science Board Study.

Summary of FY 1990 funding levels

Geodynamics	$38,000,000
Research and analysis	124,800,000
Mission operations & data analysis	24,800,000
Earth science payload instrument dev.	42,300,000
Scatterometer	13,800,000
Earth probe	10,000,000
Upper atmos res. satellite (UARS)	73,900,000
Ocean topography experiment (TOPEX)	72,800,000
Airborne science & applications	19,700,000
Total	420,100,000

The goals of the Earth Science and Applications program are to improve our understanding of the processes in the atmosphere, oceans, land surface, and interior of the Earth and advance our knowledge of the interactions among these environments. The program will provide space observations of parameters involved in these processes and will extend the national capabilities to predict environmental phenomena, both short- and long-term, and their interaction with human activities. Because many of these phenomena are global or regional, they can be most effectively (and sometimes only) observed from space. NASA's programs include scientific research efforts plus the development of new technology for global and synoptic measurements. NASA's research satellites, Shuttle/Spacelab payload program, and Airborne Science and Applications program provide a unique view of the planet Earth, its physical dynamics, and radiative and chemical processes which affect habitability and the solar-terrestrial environment.

A number of significant objectives have been established for the next decade. These include advancing our understanding of the upper atmosphere through determining the spatial and temporal distribution of ozone and select nitrogen, hydrogen, and chlorine species in the upper atmosphere and their sources in the lower atmosphere; characterizing the current state of the terrestrial landscape, including the biosphere and the hydrosphere; optimizing the use of space-derived measurements in understanding large-scale weather patterns; advancing our knowledge of severe storms and forecasting capabilities, ocean productivity, circulation, and air-sea interactions; and improving the knowledge of seasonal climate variability leading to a long-term strategy for climate observation and prediction. Studies of the cycling of key biogeochemical elements, interactions between the biosphere and the climate system, and the composition and evolution of the Earth's crust and the processes that shape the Earth's crust are essential to our understanding of the global environment.

Effective utilization of remote sensing requires a balanced set of activities including: analytical modeling and simulation; laboratory research of fundamental processes; development of instrumentation, flight of the instruments on the space shuttle, research satellites, and airborne platforms; collection of *in situ* ancillary or validation data; and scientific analysis of data. The approach is to develop a technological capability with a strong scientific base and then collect appropriate data through remote and *in situ* means, which will address specific program objectives.

Earth Science and Applications—Committee Comments

The increase in the authorization for this program, $10,000,000 more than the President's budget request, is to initiate a new start in FY 1990 for the Earth Probe program, a series of Explorer-class earth science missions. The Committee expects the TOMS to be the first Earth Probe mission and anticipates that follow-on missions will include a Tropical Rain Forest Measurement mission, a Sea-Wide Field Sensor, and a Geopotential Research Experiment mission.

The Committee's support of the Earth Probe program and the Earth Science and Applications budget request is indicative of its interest in a comprehensive global change research program. The Committee also believes that such a program is in the national and international interest and that space-based assets are a critical element of a successful global change research program.

Because of the renewed interest in the environment, in particular global warming and ozone depletion, the Committee sees a broad base of support for the NASA Earth Science and Applications program and expects that many of the already approved missions will attract further interest since they will enhance our knowledge of the planet Earth and its atmosphere. The Upper Atmosphere Research (UARS) scheduled for launch in 1991 and the Ocean Topography Experiment (TOPEX) scheduled for launch in 1992, for example, will significantly enhance our understanding of the stratosphere and the surface topography of the ocean. The Committee believes that all of these missions lend themselves to international cooperation and to an international global change research program. The Earth Probe program, in particular, is ideal for participation by developed and developing nations.

The Committee notes that the Scatterometer will be launched in 1995 on the Japanese ADEOS mission but is concerned about the launch delay experienced by this program due to uncertainty with the Navy N-Ross program. Enhanced knowledge of the oceans has important research and operational purposes and should be a higher priority.

Finally, the Committee is pleased to see NASA's sustained commitment to advanced technology development activities and to new and improved remote sensing instruments. These instruments will play a critical role in a comprehensive global change research program.

(b) Materials Processing—$90,700,000

The Committee authorizes $90,700,000 for Materials Processing in FY 1990. This is $2,000,000 less than the President's budget request. This reduction is a general reduction to be applied at the discretion of NASA.

Summary of FY 1990 funding levels

Research and analysis	$13,000,000
Microgravity shuttle/space station payloads	74,600,000
Commercial microgravity R&D enhancements	5,100,000
Total	[1] 90,700,000

[1] Total reflects a general reduction of $2,000,000 to be applied at NASA's discretion.

The mission of the materials processing Microgravity Science and Applications program is to foster the development of near-Earth space as a natural resource by exploiting microgravity and other unique attributes that may be attained in an orbiting spacecraft. In this environment, we can advance knowledge about the fundamental nature of matter, increase understanding of the role of gravity in various industrial processes, and produce limited quantities of certain exotic high value materials for specialized applications.

Ground-based research will support definition studies for shuttle and Space Station experiment candidates in areas such as containerless experiments, solidification and crystal growth, and processing of biological materials. Experiments will be conducted in drop tubes, towers, and aircraft.

The Microgravity Shuttle/Spacelab Payloads program provides a range of experimental capabilities for all participants in the Materials Processing in Space program. The payloads program currently supports a wide variety of hardware development, from unique flight experiments necessary to conduct basic research into the fundamental nature of matter to the modular, multi-user research facilities that will be the cornerstone of microgravity science and applications research on the Space Station. Experiments will be flown on the space shuttle and Spacelab.

Materials Processing—Committee Comments

The Committee continues to be supportive of the Materials Processing program and believes that the long-term return from this program will be substantial. However, the Committee also realizes, as noted in the National Research Council's "Report of the Committee on a Commercially Developed Space Facility," that "microgravity science is at an immature stage due to the lack of fundamental processes involved in this area of space research. As more experimentation takes place, a data base of results will be acquired, and it will become possible to strategically plan the future microgravity research program."

Based on this assessment, the Committee recognizes the importance of flight opportunities for the microgravity research program and urges NASA to do everything possible to provide frequent flight opportunities. The scheduled Spacelab mission and Secondary Payload opportunities are ideal for microgravity research, as will be extended duration orbiter and Spacelab missions when they become available. Expendable launch vehicles with or without reentry vehicles also provide research opportunities, as do drop tubes and aircraft. The Committee believes strongly that a well-designed research program must be implemented to ensure effective utilization of the space station and to gain an advantage on foreign competition for commercial markets.

(c) Communications—$80,600,000

The Committee authorizes $80,600,000 for Communications in FY 1990. This is $62,000,000 more than the President's budget request. This increase is required to fulfill the Government's commitment to develop the ACTS.

Summary of FY 1990 funding levels

Advanced communications technology satellite (ACTS)	$62,000,000
Advanced communications research	12,700,000
Search and rescue	1,300,000
Radio science and support studies	3,100,000
Communications data analysis	1,500,000
Total	80,600,000

Advanced communications research continues to provide the development of subsystem component technology required by NASA, other government agencies, and U.S. industry for advanced communications satellite systems. Special emphasis is being given to technologies with high potential for improving spectrum utilization, satellite switching, and intersatellite link technologies, since these technologies are the key future growth of the communication satellite and terminal markets. The mobile communications technology program will complete development of critical enabling technologies needed to ensure growth of a commercial mobile satellite service in the United States.

The Search and Rescue program is an international cooperative program that demonstrates the use of satellite technology to detect and locate aircraft or vessels in distress. The United States, Canada, France, and the Soviet Union developed the system in which Norway, the United Kingdom, Bulgaria, Sweden, Denmark, Switzerland, Brazil, and India also participate.

Radio science and support studies provide the technical basis to support U.S. and specifically NASA interests in international and domestic communications regulatory forums. Propagation studies and measurements are performed in order to understand and account for the effects of propagation in the design and specification of space communications systems. Studies to enable new satellite applications are conducted.

Communications data anaylsis assists other Federal agencies and public sector organizations in the development of experimental satellite communications for emergency, disaster, and public service applications. The main areas of work will be preparation for future optical communications experiments and operation of the Applications Technology Satellite (ATS–3), launched in 1967.

Communications—Committee Comments

The ACTS program is critical to the future of the United States in the world communications market. At a time when the U.S. suffers from an adverse balance of trade and the Europeans and Japanese are mounting substantial threats to our share of the world communications market, ACTS allows the Government and private sector to cooperate to share the high costs and risks associated with the development of new technologies. The ACTS program is patterned on such a cooperative venture and represents a conscious effort on the part of the Congress to sustain the Nation's leadership in communications.

Accordingly, the Committee instructs NASA to proceed vigorously with the ACTS program in order to have the satellite ready for launch in 1992.

(d) Information Systems—$34,100,000

The Committee authorizes $34,100,000 for Information Systems in FY 1990. This is the same as the President's budget request.

Summary of FY 1990 funding levels

Data systems	$18,400,000
Information systems	15,700,000
Total	34,100,000

The information systems program applies advanced computer and information systems technology to support the Office of Space Science and Applications (OSSA) science program. This includes data management, scientific computing, networking, and other science information needs. The program provides ongoing support to the OSSA research community through the NASA Space and Earth Sciences Computing Center (NSESCC) for supercomputing resources in support of modeling and simulation efforts, and the National Space Data Center (NSDC) for archival and distribution of data acquired from spaceflight experiments and observations.

The data systems element develops and applies advanced capabilities for managing, distributing, and analyzing data and information. This includes development of generic tools and capabilities to enhance the science productivity derived from data acquired from space flight observations and experiments.

The data systems element also incorporates the OSSA computer communications for science network activity. The computer communications for science network will extent scientists' access to space data and computational resources and simplify communications and collaboration among NASA's space science and applications communities. Through FY 1988, the NASA science networks were funded as part of the program support communications network. In FY 1989, the network is funded by OSSA science missions and disciplines. Beginning in FY 1990, computer communications for science network is an element of the data systems budget.

Included in information systems is a new emphasis on science data management and archival systems to provide the OSSA research community with a faster, more reliable system to assimilate, archive, and distribute data. With the return of the shuttle to operational status, a six-fold increase in data holdings is expected, resulting from missions like Cosmic Background Explorer, Roentgen Satellite, Gamma Ray Observatory, International Solar Terrestrial Program, the UARS, and Spacelab missions. OSSA researchers will benefit from automated retrieval of off-line data from large archives, implementation of a master directory for location of distributed data sets by researchers, catalog inter-operability for common searches across distributed data bases, delivery of data on advanced media as requested by users, and utilization of data exchange standards to facilitate automated assimilation of data by user applications. The augmentation will build on the information systems program to emphasize standards, to evolve a unified but distributed system for managing data and information, and to evaluate changing technology options in a system framework.

Information Systems—Committee Comments

The Committee continues to support these programs and believes strongly that NASA must focus increased attention on the issues of data management, data distribution, data archiving, and networking as NASA prepares to enter the information age. News stories with headlines like "What Becomes of Data Sent Back from Space? Not a Lot as a Rule." are very disconcerting to the Committee. There is a "Crush of New Data Knocking at the Door" as described in the "Renewable Resources Journal" article by Ralph Kahn and Henning Leidecker, and NASA must have an efficient and effective system in place to manage, utilize, distribute, and store this data.

The Committee expects NASA to provide the resources required to develop this complex data management system and to formulate a comprehensive strategic plan for this purpose with the other Federal agencies involved.

7. Mission to Planet Earth-Earth Observing System—$24,200,000

The Committee authorizes $24,200,000 for the Mission to Planet Earth-EOS. This is the same as the President's FY 1990 budget request.

To manifest its strong commitment to the Mission to Planet Earth proposal, the Committee has established a separate line iten for this program in the bill as reported and has instructed NASA to complete Phase B activities and initiate Phase C/D activities in FY 1990. This latter provision gives the project new start status.

Summary of FY 1990 funding level

Mission to Planet Earth-Earth Observing System	$24,200,000

Mission to Planet Earth consists of both space and ground elements. The space elements include a series of Earth observing platforms, both small and large, in various orbits about the Earth, and instruments attached to the SSF. The purpose of the space elements is to gather long-term, global data sets on the surface and atmosphere of the planet. The principal ground element is a data and information system within which one would gather, process, and archive the data arriving from the space elements. The information archived in the data and information system will be accessible by the entire world-wide scientific community. The information would consist of global maps of surface temperature, precipitation, soil moisture, cloudiness, radiation budget, and other such global data sets required to understand the state of the Earth and any trends for change—just as one now uses weather satellites to understand the state of the weather and trends for change.

The complete vision of Mission to Planet Earth also includes surface science stations underlying satellite ground tracks and various experiments using aircraft, balloons, and rockets underflying the satellites. These surface and suborbital platforms will provide *in-situ* calibration and validation of the remote sensing instruments on the satellites and will conduct process studies on how the Earth works as a system so that scientists will know how to construct predictive models of how the Earth works as a system. Many of these surface and suborbital operations would be conducted by agencies other than NASA, the National Oceanic and Atmospheric

Administration (NOAA), the National Science Foundation (NSF), the U.S. Geological Survey (USGS) and others who currently have roles in Earth research.

Mission to Planet Earth is designed to understand the Earth as a global system, to determine the processes that create global environmental balance, to identify the processes that lead to change in this balance, and ultimately to provide the capability to reliably predict global change. It is, therefore, a mission which responds directly to the needs of both researchers and policymakers on the issue of global change.

The NASA portion of the "Mission to Planet Earth" involves the use of the space observation platforms, data and information systems, Earth process studies, and global Earth system models required to understand the global environmental system and its changes. However, NASA's Mission to Planet Earth is part of the larger U.S. Global Change Research Program, which is turn contributes to an international scientific plan of global research organized by the International Council of Scientific Unions (ICSU) and called the International Geosphere Biosphere Program (IGBP). NASA has a crucial role in the U.S. Global Change Program, which is to provide the long-term, global observations from space and the associated data and information system that is absolutely essential for understanding the Earth, for detecting global change, and for validating a new generation of predictive global change models.

The problems associated with global change are clearly global in nature, and, while the method of choice for studying the problems is observations from space, NASA alone cannot do it. Remote sensing data from space requires complimentary ground-based studies for validation and for focused process studies, and these studies must be conducted in many places around the world. The cooperation of many countries will be required under the auspices of the IGBP. Fundamental studies of physical, chemical, and biological processes of all kinds are required. NSF leads many of these efforts. NOAA will provide important data on the immediate state and short-term behaviour of the global environment using operational weather satellite data. USGS and NSF can provide studies of the Earth's past climate from paleontological studies and from ice sheet cores. These paleoclimatic data are invaluable for testing the validity and robustness of modern global change models. The U.S. Federal agencies have come together under the auspices of the Committee on Earth Science (CES) to define a U.S. Global Change Program together with roles for each of the agencies.

There are many Government agencies and international scientific societies that must work together in the spirit of a Mission to Planet Earth in order to udnerstand our planet and what we are doing to it. However, at the heart of all these efforts—essential to their success—is the global data set on the Earth and how it is changing. This global data set can only be provided from space by NASA and the other spacefaring nations of the world. Some 23 of the national space agencies of countries around the world have formed, under NASA leadership, the Space Agency Forum for the International Space Year (SAFISY) to coordinate International Space Year (ISY) activities with a major theme being Mission to

Planet Earth. It is a fitting theme for the ISY, which was first suggested by Congress and then proclaimed by President Reagan. NASA, which has the responsibility for the ISY in this country, has been encouraging the ISY to give particular emphasis to the study of the Earth—not only space observations but also complimentary ground-based studies by all nations of the world which have space activities. The ISY culminates in 1992 and will provide the lead-in to the era of the 1990's when the IGBP and major national programs in global change will begin.

NASA currently has a strong program in the Earth science that will build to a Mission to Planet Earth in the 1990's. The Earth Science and Applications Division in OSSA has an extensive research and analysis program which primarily funds the university community combined with a suborbital program of experiments using aircraft, balloons, and rockets to study a variety of Earth Processes. In addition to the suborbital platforms, NASA is developing a number of scientific instruments for flight on the space shuttle, SSF, and free-flying satellites. These instruments will conduct focused Earth studies in preparation for the space components of Mission to Planet Earth. Several older spacecraft are still collecting global Earth data including Nimbus-7 and the Earth Radiation Budget Satellite.

NASA currently has under construction three satellite projects which will provide important data on global change up until the time we can begin Mission to Planet Earth. The UARS scheduled for launch in 1991 will provide definitive measures of the chemistry and dynamics of the upper atmosphere and provide for a complete, global set of atmospheric data for the Earth's ozone layer. Topex/Poseidon is a going project with France to measure with great accuracy the height of the world's oceans, from which global ocean circulation can be inferred. It is scheduled for launch in 1992. The results from this mission have a strong relationship to those of the NASA Scatterometer, which has been selected preliminarily for flight on the Japanese ADEOS satellite in 1995, and which will measure wind stress on the ocean surface for determination of ocean currents. These projects address the coupling between the oceans and the atmosphere, which is key to understanding how the two principal system of the Earth's climate operate together.

Each of these missions attacks a focused problem important to understanding our global environment. They do not, however, deal with the Earth as an integrated system. We need to observe the component parts of the Earth simultaneously to achieve an integrated understanding of how the atmosphere, ocean, ice, and biosphere interact and operate as a system. These are the objectives of Mission to Planet Earth.

Global changes in the atmosphere and on the surface of the Earth have already been observed, and the impact of these changes in uncertain. We now have the ability to observe the Earth from space as a system, and we have the technology and scientific expertise to tackle Earth system science. There is a world-wide awareness of the problem of global change, and international and interagency cooperation is growing. There is a growing public awareness of changes in the global environment that demand attention, which

creates the opportunity to demonstrate U.S. leadership in an area where citizen of the world will ultimately benefit.

Mission to Planet Earth consists of four major types of space components:

1. Earth Observing System/Polar Platforms (EOS),
2. Space Station Attached Payloads,
3. Earth Probes, and
4. Geostationary Platforms.

However, the central component of Mission to Planet Earth is the Earth Observing System Data and Information System (EOSDIS). This system provides for central receiving, processing, and archiving of the data from the space elements of Mission to Planet Earth. Its initial implementation will be completed for EOS, the first space element. There are two competitive Phase B studies funded for the design of the EOSDIS.

The information resident in the EOSDIS will be used by scientists all over the world to conduct research on Earth system science and global change. Global-scale Earth system models will be constructed, the descendants of today's global change models, and will be tested against the long-term, global data sets in the EOSDIS. These models will incorporate information on Earth system processes that result from Mission to Planet Earth research and analysis programs. The ultimate product of Mission to Planet Earth will be validated global, interactive Earth system models with the ability to predict future global change to an accuracy sufficient for future policymakers.

Mission to Planet Earth will be the largest scientific undertaking in the history of NASA. Due to the global nature of the problem this mission addresses and the interest of most of the world in the goals of the mission, Mission to Planet Earth will involve cooperation and cost-sharing by most of the major spacefaring nations of the world under the leadership of the United States. Even so, the cost to this country for the full complement of this mission during the peak years in the late 1990's could be more than $2,000,000,000 per year. This is five times the present amount spent on Earth science programs in NASA. These costs are large enough to require strong leadership and commitment to the issue of global change. The benefits, however, are many:

1. a critical investment in preserving the global environment and in providing the information required to cope with the potential for future global change;
2. utilization of the U.S. investment in space research for a purpose which everyone can see and appreciate and for providing direct benefit to the citizens of the United States;
3. an international effort in space demonstrating U.S. leadership and with the potential to motivate additional commitments to this effort by both our economic summit partners and the Soviet Union;
4. demonstration of U.S. commitment to investment in a better global future with benefits which accrue to everyone, in particular the next generation; and
5. an idea which stirs popular ideals, continuing the inspirational tradition of space activities.

Mission to Planet Earth—Earth Observing—Committee Comments

For nearly 20 years, since the first American left his footprints in the dust of the moon, this Nation has been in search of major goals for its civil space program. Many goals have been proposed, but the mission to Planet Earth has succeeded in capturing the imagination of the American people, the world community, and the Congress.

Maybe that is because of the renewed worldwide interest in global change and our fragile planet Earth, or maybe it is because of our basic desire to know more about ourselves and the planet we inhabit. Whatever the reason, the concept of a Mission to Planet Earth has been recognized by the Committee as a goal worthy of pursuit and as a priority within the civil space program's agenda.

In light of growing world interest in global change issues, a comprehensive, international study aimed at understanding our planet and the changes which are taking place should be a high priority in the FY 1990 NASA Authorization Bill. The guiding principle behind the Mission to Planet Earth initiative endorsed by the Committee is an integated approach to observing our planet and how its various components function, interact, and will evolve over time. Eventually, the Committee assumes that such an approach should give us the capability to predict changes that might occur—either naturally or as the result of human activity.

The proposed integrated system endorsed by the Committee would establish and maintain a global observation system in space consisting of free-flying platforms in polar, low inclination, and geostationary orbits that are coordinated with ground-based measurements. The data from all of these observations would be integrated by a versatile, state-of-the-art information management system—an essential element of the data analysis and numerical modeling capabilities of the proposed system.

Developed independently from other global change research proposals, Mission to Planet Earth shares many of the same research elements and objectives. The proposed integrated system would measure the full complement of the planet's characteristics, including: global cloud cover, vegetation cover, and ice cover; global rainfall and moisture; ocean chlorophyl content and ocean topography; motions and deformations of Earth's tectonic plates; and atmospheric concentration of gases such as carbon dioxide, methane, and ozone. As such, this system would be a principal component of an international, interdisciplinary global change research program.

Because of the complexity of this system and the requirement for a broad range of scientific activities, the Mission to Planet Earth will require the support and involvement of several U.S. Government agencies—NASA, NOAA, DOD, Office of Science and Technology Policy (OSTP) within the White House, and USGS—as well as our international partners. The roles and responsibilities of these Federal agencies in such a program have been examined in detail by CES of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET). FCCSET recently released a detailed Global Change Research Plan.

To ensure that the measurements of the proposed system are globally complete, simultaneous, and continuous, significant inter-

national participation and cooperation will be required. International participation is needed to support space observing systems and to deploy and operate in situ measuring devices. Site selection, standardization of equipment, data rates and formats, and data exchange protocols are examples of the issues that must be resolved to ensure the success of Mission to Planet Earth.

An excellent record of international cooperation in large-scale earth sciences projects has already been established. Examples include the International Geophysical Year of 1957, the Geodynamics Program, the Global Atmospheric Research Program, the International Lithosphere Project, the Ocean Drilling Programs, the World Climate Research Program, and the Man and the Biosphere Program. In addition, the member nations of the IGBP, which is aimed at an understanding of global change, are making steady progress and should be ready for implementation of a comprehensive research program in the early 1990's.

Finally, the U.S ISY Association has made the Mission to Planet Earth a major theme of the ISY which is scheduled for 1992. Senior space officials from 23 nations are now working with the U.S.-ISY Association to encourage Mission to Planet Earth activities.

At present, there is not a precise cost estimate of the Mission to Planet Earth. This lack of specificity stems from the fact that the program has not been formally defined, nor has the potential for international participation and financial contributions been thoroughly assessed.

However, the Committee believes strongly that the Mission to Planet Earth can be designed to cost. The Committee instructs NASA to submit a cost estimate for its portion of the Mission to Planet Earth program in conjunction with the FY 1991 Budget Submission.

In the reported bill, the Committee has endorsed the first two elements of a comprehensive Mission to Planet Earth—the EOS, or the space station polar platforms, and the Earth Probes program—and has given both programs "new start" status. The Committee realizes that the scope of the EOS system has not been fully defined as of yet. The Committee, therefore, recommends that NASA properly balance the science and hardware elements of the EOS program in the Phase B definition period. The primary goal of the EOS program is the long-term acquisition of the scientific data related to global environment. To the extent the EOS program pushes technology development, the Committee would recommend that the focus the data management, information systems, and instrumentation. In this regard, the Committee notes with interest the recent decision by the ESA, concerning their proposed space station polar platform, to proceed with a smaller, less complex system.

The Committee is concerned that the broad base of support for the Mission to Planet Earth could be misinterpreted by some parties to be a blank check. The Committee expects NASA to understand that cost containment will be a critical element of this program and that NASA's ability to manage to cost will be a critical factor in determining the scope of this program and the number of platforms included in the final configuration.

The Committee also notes that NASA is but one player in a comprehensive Mission to Planet Earth. NOAA, NSF, USGS, and DOD also will play critical roles in a fully integrated system as will our international partners—developed and developing nations. Although NASA's space-based assets are a critical element of the program, the Committee realizes that the requirements of the other players also must be addressed. Effective and efficient utilization of the data generated by this program will require a well-designed supercomputer network and a cadre of skilled and dedicated scientists, engineers, climate modelers, and technicians. The goal of the program is not to collect data but to be able to interpret data and to predict changes that might occur either naturally or as the result of human activity. The Committee, therefore, is very supportive of making the assembly of professional talent a key element of the R&D program.

8. Commercial Programs—$61,000,000

The Committee authorizes $61,000,000 for Commercial Programs in FY 1990. This is the same as the President's budget request.

Summary of FY 1990 funding levels

Technology utilization	$22,700,000
Commercial use of space	38,300,000
Total	61,000,000

The Technology Utilization program promotes the transfer of technology developed in NASA's R&D programs to the public and private sectors of the U.S. economy. A network of Industrial Applications Centers, Technology Counselors, and NASA Installation Technology Utilization Officers form the core of the Agency's technology transfer efforts. Technologies developed for the Nation's aerospace program are reused or reengineered to provide new products and processes in the areas of transportation, energy, medicine, public safety, and consumer goods. The goals of the program are to broaden and accelerate the technology transfer process, to realize additional dividends on the national investment in aerospace research, and to ensure that the United States maintains its competitive position in the international marketplace.

NASA's goal of expanding opportunities for U.S. private sector investment and involvement in civil space and space-related activities is pursued through a variety of interrelated programs. Through cooperative agreements such as Joint Endeavor Agreements (JEAs) and through support to the Centers for the Commercial Development of Space (CCDS), NASA will increase the amount of space-related research conducted by the private sector, the number and type of NASA and private sector facilities available for space use, and the private sector awareness of the opportunity to use NASA's terrestrial and space-based facilities for commercial research.

Resources will be made available to obtain flight support experimentation hardware required by industrial researchers. This may include across-the-bay carriers, such as Materials Science Laboratories, as well as middeck augmentation racks of derivatives thereof, and the possible leasing of private sector hardware developed to ex-

ploit commercial research and development in space. The use of ground-based research facilities, aircraft, and sounding rockets for commercial experimentation will be given emphasis in order to provide limited access to the microgravity environment for appropriate commercial experiments.

In order to maintain momentum in commercial use of space activities and to encourage an increase in private sector investment in space, NASA will continue to develop methods to facilitate private sector agreements and commitments to develop commercial opportunities in space. The development of agreements for the use of the shuttle external tanks and private sector use of U.S. launch facilities reflect this effort. The use of Space System Development Agreements (SSDAs) will continue.

Commercial Programs—Committee Comments

The Committee strongly endorses NASA's initiatives to formulate JEAs, memoranda of understanding and agreement, and modified launch services agreements to stimulate interest in space commercialization in the private sector and university community. The Committee also believes that the Congress and Administration should work together to foster the conditions necessary to facilitate implementation of these innovative programs.

Despite expressions of support from many corners concerning space commercialization, there are still many obstacles to the commercialization of space, including economic, regulatory, institutional, and insurance barriers, not to mention stiff foreign competition. During the course of the next year, the Committee intends to work closely with the various parties to try to establish conditions conducive to eliminating these barriers.

Last year, the Committee worked closely with the expendable launch vehicle (ELV) industry to establish an indemnification regime that would put domestic ELV operators on an equal footing with their foreign competition. The Committee is continuing to work with the ELV industry, NASA, DOT, and the Air Force to formulate a model launch service agreement and request for proposal for government procurement of launch services. The Committee also intends to work with firms and university consortia that have memoranda of understanding, memoranda of agreement, and JEAs to reduce barriers that impede implementation of their projects.

The Committee is pleased about the response to the NASA Commerce Business Daily announcement concerning the use of jettisoned external tanks and the progress NASA is making in negotiating memoranda of understanding as a result of this announcement. NASA already has one such agreement with a university consortium, the University Corporation for Atmospheric Research, for suborbital applications and is negotiating three additional memoranda of understanding for orbital use of the external tank. The use of this existing space hardware presents some interesting opportunities for government, university, and private sector applications.

The Committee also is pleased to see the detailed set of findings and recommendations formulated by the NASA Commercial Pro-

grams Advisory Committee. The Committee intends to review closely these recommendations and where necessary to consider legislation.

The Committee continues to support NASA's efforts in this area and strongly supports the CCDS. NASA's efforts to get flight opportunities for the CCDSs using commercial launch operators and streamlined regulatory processes are laudable. The Committee hopes NASA continues to pursue these initiatives and that NASA will avail itself of Spacelab to help provide flight opportunities for the CCDSs and JEAs. As noted in other sections of this report, every effort must be made to increase flight opportunities for basic and applied research and commercial applications.

9. Aeronautical Research and Technology—$462,800,000

The Committee authorizes $462,800,000 for Aeronautical Research and Technology in FY 1990. This is the same as the President's budget request. However, the Committee has instructed NASA to initiate a $10,000,000 High Performance Computing Initiative in the FY 1990 budget and to absorb the cost of this program. The Committee has also endorsed the President's request for $25,000,000 to initiate technology efforts related to the development of an environmentally and economically sound high speed commercial transport.

Summary of FY 1990 funding levels

Research and technology base	$335,700,000
Systems technology programs	127,100,000
Total	[1] 462,800,000

[1] Within this amount, NASA must absorb the cost of the High Performance Computing Initiative ($10,000,000).

The goal of the NASA aeronautics program is to conduct research and develop technology to strengthen U.S. leadership in civil and military aviation. This goal is supported by five comprehensive program objectives: (1) to emphasize emerging technologies with potential for major advances in capacity and performance; (2) to maintain NASA's laboratory strength by repairing and modernizing critical aging national facilities, providing advanced scientific computational capabilities and enhancing staff technical excellence; (3) to ensure timely transfer of research results to the U.S. aeronautics community through reports, conferences, workshops, and cooperative research programs with industry; (4) to ensure strong university involvement to broaden the Nation's base of technical expertise and innovation; and (5) to provide technical expertise and facility support to DOD, other government agencies, and U.S. industry for major aeronautical programs. The program is based on a strong commitment to revitalize American competitiveness in the world aviation marketplace, enhance the safety and capacity of the national airspace system, and assure U.S. superiority for national security.

In order to continue to meet the international challenge in aeronautics, the aeronautical research and technology program needs to address critical barriers and strengthen generic technology development in selected high payoff areas that are vital to our long-

term leadership in aviation. NASA's FY 1990 aeronautics program is focused on achieving the objectives established in the report, "National Aeronautical R&D Goals: Technology for America's Future," by OSTP, and in its sequel report, "Agenda for Achievement."

There are many important elements of the research and technology base and systems technology programs. Fluid and thermal physics research will continue to focus on developing faster and more efficient algorithms for numerical simulation of aerothermodynamic phenomena. In applied aerodynamics, the augmented research program in FY 1990 will emphasize improved fundamental understanding of stationary and rotating turbomachinery flowfields through development of advanced computational analysis methods and their applications at the component and subsystem level. Materials and structures research will continue to develop advanced materials and innovative structural concepts aimed at reducing aircraft weight and cost. Research in information sciences will continue to investigate concurrent processing architectures and algorithms for application to increasingly complex aerospace computational problems and will emphasize advanced software engineering for complex, highly reliable applications. Controls and guidance research will continue to provide a technology foundation in advanced systems for application to future aerospace vehicles, with emphasis on guidance and control for highly agile aircraft. Human factors research will continue development of methodologies required for safe and effective crew/cockpit interfaces with particular emphasis on highly automated aircraft operating in the future national airspace system. Flight systems research will be augmented to increase emphasis on high angle-of-attack technologies through simulation, wind tunnel tests, and flight evaluation.

Systems analysis studies will continue to focus on defining the research and technology needs for advanced high speed transport aircraft, high speed rotorcraft, and supersonic short takeoff and vertical landing fighter aircraft. In materials and structures systems technology, advanced composite materials research will continue in high-temperature materials while expanding its focus on application of composites to primary aircraft structures. Rotorcraft systems technology research will continue the FY 1989 effort in noise prediction, code validation, and envelope expansion of the XV-15 tiltrotor with advanced technology blades. In high performance aircraft systems technology, flight system research will start a new focus on high speed flight, addressing environmental issues such as ozone depletion, airport noise, and sonic boom. Advanced propulsion systems technology will focus primarily on high speed turboprops with specific emphasis on improved understanding, modeling, and code validation of flowfields, structural response, noise characteristics, and installation effects. The numerical aerodynamic simulation capability will be enhanced with the acquisition of the third high speed processor.

Aeronautical Research and Technology—Committee Comments

During the 101st Congress, the Committee has been exploring a variety of ways to stimulate technology development activities in

Federal civil agencies, in particular activities that will permit the United States to maintain a competitive advantage in the world's high technology marketplace. The Committee believes that the High Performance Computing Initiative, which will advance the development of the next generation of computers, is one of the technologies essential to progress in science and engineering, to the national security and industrial productivity of the United States, and to the future competitiveness of the aerospace industry.

The Committee is concerned that the lead in high performance computing the United States has enjoyed is being challenged from abroad. The Committee believes that needed progress in computing can be accelerated through an increased emphasis on the pioneering of multidisciplinary applications, systems software, peripheral systems, networks, high speed architecture technologies, and the effective commercialization of these technologies, and that an initiative incorporating these elements is required. The basic elements of such a program were outlined in the OSTP report entitled "A Research and Development Strategy for High Performance Computing," published on November 20, 1987, which serves as the basis for the Committee's High Performance Computing Initiative.

Semiconductor technology will now permit a new generation of large-scale parallel architectures. The challenge is to stimulate high performance computer technology so that commercial systems can be developed which will permit NASA to meet its grand challenges in a timely and competitive manner and that will permit the United States to maintain its leadership posture. Current semiconductor technology and the speed of light limit single-processor supercomputers to approximately one billion floating point operations per second (1 gigaFLOPS). The objective of the Committee's initative is to achieve a thousand-fold increase in performance. The timing of this initiative is such that the proposed NASA program can build on recent advances in parallel and distributed processing which have demonstrated the potential for advancing computational capabilities by orders of magnitude. In order to exploit massive parallelism, many separate, yet interconnected processors must be effectively coordinated to work concurrently on a single problem. Innovations in computing systems (hardware and software) are required as well as advances in applications and algorithms. The Committee's initiative is intended to address both hardware and software challenges to achieve fully operational parallel and distributed systems that deliver high performance and provide programming and operating environments that allow scientific and engineering users to work effectively. As importantly, the Committee's initiative is meant to stimulate government/industry research activities that will enhance the competitiveness of the United States in the world marketplace.

The Committee expects NASA to formulate an implementation plan for the High Performance Computing Initiative and to submit this plan to the Committee by October 1, 1989.

Overall, the Committee continues to support strongly the NASA aeronautical research and technology program and sees this program as a critical element of the success of the U.S. aerospace industry in the world marketplace. The Committee is pleased, therefore, in light of the language contained in the Committee's FY 1989

NASA authorization report, to see a high speed commercial transport initiative in the FY 1990 budget request. The Committee strongly endorses this initiative. The Committee realizes the potential market for long-range trans-Pacific aircraft—cargo and passenger aircraft—is significant and will profoundly impact the airline and aircraft industry in the next century.

Although the "economics viability" of any new high speed commercial aircraft will be a significant factor in assessing marketability, the Committee also realizes that "environmental acceptability" will be a significant factor. The Committee, therefore, supports the high speed commercial transport research and technology program's focus on key environmental concerns—sonic boom, airport noise, and ozone depletion—and NASA's creation of a High Speed Civil Transport Atmospheric Advisory Committee to assess the key environmental issues. NASA has properly identified environmental concerns as a high priority and as a focal point of a successful engineering and research program.

10. Transatmospheric Research and Technology—$127,000,000

The Committee authorizes $127,000,000 for Transatmospheric Research and Technology in FY 1990. This is the same as the President's budget request and manifests the Committee's strong support of the NASP program.

Summary of FY 1990 funding levels

Transatmospheric research and technology	$127,000,000
Total	127,000,000

The NASP program is a joint effort between NASA and DOD to accelerate the development of critical enabling technologies for a revolutionary class of hypersonic-transatmospheric vehicles. Such vehicles could be capable of taking off from and landing on conventional runways, using airbreathing propulsion up to, or near, orbital speed, and providing rapid and lower cost access to space. The program will accelerate the development and validation of key technologies through application of analytical prediction methods coupled with testing in ground-based facilities. The critical technologies being pursued in the current phase of the program include efficient airbreathing propulsion systems, with emphasis on scramjet performance that provides the necessary thrust from takeoff to near orbital speeds; reusable thermal structures that can withstand repeated combinations of extreme peak heating and significant long duration heat loads; and complete integration of the propulsion system with the airframe for a minimum weight system with good performance throughout a broad range of accelerating, cruising, and maneuvering flight conditions. A necessary precursor or to the development and flight validation of an experimental vehicle (X–30), these technologies will form the critical data base required for design and integration of complex propulsion and structural systems into a vehicle configuration capable of transatmospheric flight.

The FY 1990 NASP activities are expected to emphasize extensive detailed design, component fabrication, and tests by the engine and airframe contractors, as well as continued refinement of the

supporting technology maturation effort in preparation for the decision on whether to proceed with development of the X-30 research vehicle. The technology maturation activities will concentrate on four key objectives: (a) an airbreathing propulsion system with high specific impulse; (b) vehicle structural weight improvement with reusability and durability over a wide temperature range; (c) integrated systems and subsystems in aeropropulsion, thermal management controls, and others; and (d) sound design and analysis tools based on advanced computational methods fully verified by test.

Transatmospheric Research and Technology—Committee Comments

In authorizing the full $127,000,000 requested by the President for Transatmospheric Research and Technology in FY 1990, the Committee underscores its strong support of the NASP program. While the focus of the program is restricted to the development of the supporting technologies and the subsequent design and construction of an experimental plane with which to test those technologies, the potential NASP spinoffs cannot be ignored. NASP may well lead to commercial transports capable of reaching virtually any destination in the world in several hours or less. NASP also may eventually emerge as a less expensive and more efficient substitute or alternative to the space shuttle and ELVs as a means for placing payloads in space. Equally promising are the military applications.

Because of the importance of NASP to the U.S. economy and the future of aeronautics, the Committee was very concerned when the President's original budget request was amended by the Secretary of Defense and the proposed funding for NASP of $300,000,000 in the FY 1990 DOD budget was deleted. The Committee was pleased that the Administration showed its commitment to NASP by directing the National Space Council to reassess the DOD proposal and to assess the proper scope and timetable for the program and the appropriate division of responsibilities between NASA and DOD.

Based on that review, the Space Council strongly recommended to the President that the NASP program be continued and urged a funding scheme whereby NAS and DOD would each contribute $127,000,000 in FY 1990 to the program. Because the proposed $254,000,000 funding level is still less than optimal and significantly below the original NASA/DOD FY 1990 request of $427,000,000, NASP, under the Space Council plan, would be restricted to a technology-oriented project and the time frame for the decision on whether to build an X-30 experimental aircraft would be moved from September 1990 to March 1992. Nevertheless, even this scaled down and stretched out version of NASP is certain to produce numerous significant breakthroughs for the United States in the field of aeronautics. For that reason, the Committee is pleased to authorize the full $127,000,000 requested by the President to fulfill NASA's duties under the program.

In light of the National Space Council's decision to reduce the level of effort of the technology program and to stretch out the program schedule, the Committee directs NASA to submit a revised

management plan for NASP including the goals, objectives, milestones, and proposed budgets for the program. This plan is to be submitted to the Committee within 60 days of the date of enactment of this bill. The FY 1990 authorization of appropriations for NASP is contingent upon submission of this plan.

11. Space Research and Technology—$325,100,000

The Committee authorizes $325,100,000 for Space Research and Technology in FY 1990. This is $13,000,000 less than the President's budget request.

Summary of FY 1990 funding levels

Research and technology base	$130,100,000
Civil space technology initiative (CSTI) program	144,500,000
Pathfinder program	40,300,000
In-space experiments technology program	10,200,000
Total	325,100,000

The overall goal of the space research and technology program is to provide advanced, enabling technologies, validated at a level suitable for user readiness, for future space missions in order to ensure continued U.S. leadership in space to meet national needs. To achieve the goal, a commitment is required to provide a broad base of advanced technology for vehicle and subsystem concepts, components, devices, and software; to develop technology strengths in the engineering disciplines within NASA, industry, and academia; and to perform critical technology demonstrations that facilitate the transfer of new technology with a high level of confidence to future space missions.

The space research and technology program consists of two basic program areas, the research and technology base and focused programs. The objective of the research and technology base program is to gain a fuller knowledge and understanding of the fundamental aspects of phenomena and observables in critical disciplines. Within the research and technology base program, high-leverage technological advances and concepts are brought to the level of demonstrating proof of principle. The base program is the seedbed for generating the more highly mission-focused technology program.

Focused programs, designed and implemented based on requirements provided by the potential users of the technology, develop technology for specific applications and deliver products in the form of proven hardware, software, and design techniques and data. Two focused programs are currently under way, the Civil Space Technology Initiative (CSTI) and Pathfinder. The CSTI program is a positive first step to strengthen the agency's technical base and provide options for future low Earth orbit high priority civil space goals. CSTI is developing technologies to enable efficient, reliable access to Earth orbit; enhance operations in low Earth orbit; and increase the effectiveness of science missions from low Earth orbit. The Pathfinder program, an element of the new national space policy, is developing critical capabilities to enable potential future missions, both human and robotic, to expand human presence and activities beyond Earth's orbit into the solar system. It will push U.S. technology forward through a strong part-

nership between NASA, industry, and universities. Proof-of-concept testing for mission-critical engineering designs will be an important product of the CSTI and Pathfinder programs and will directly support the continuing evolution and maturation of mission plans.

The In-Space Experiments Technology program is an important new program designed to provide validated, advanced space technologies to the designers for improving the effectiveness and efficiency of current space systems and to provide major advancements for future systems. Previous efforts over the past few years have identified advanced, highly innovative technology concepts that require testing or validation in the actual space environment in order to reduce the risk to the potential users, to increase the rate of transfer of advanced technologies into future space missions, and to begin to prepare for conducting technology experiments using SSF.

Space Research and Technology—Committee Comments

In FY 1990, the Committee has reduced the budget request for the Pathfinder program by $7,000,000 to $40,300,000, the FY 1989 level of funding. The Committee assumes that all elements of the Pathfinder Program will be frozen at the FY 1989 level, including the SP–100 program.

In January, the Committee received from NASA a report that outlined a variety of human exploration, unmanned exploration, and Earth-oriented applications for nuclear powered reactors—"NASA's Need for Advanced Nuclear Powered Reactors." Pursuant to that report, it is clear that Phase II of this technology program is to extend from 1988 to 1994 and is to include the engineering development and ground testing of major subsystems for space reactor power systems. The Committee supports these ground-based activities and reserves judgment on Phase III of the program—space-based testing—until a later date and a more thorough assessment of the requirements for space-based reactors.

The Committee understands that the Memorandum of Understanding between NASA, the Department of Energy (DOE), and DOD for the SP–100 Program is being renegotiated and updated. The Committee expects to be provided a copy of this agreement as soon as it is completed.

In the FY 1990 authorization bill, the Committee has supported NASA's new initiative for the In-Space Experiments Technology Initiative. However, due to budget pressures, the Committee has reduced this new initiative by $6,000,000 in FY 1990, to $10,200,000.

The Committee continues to support space research and technology and sees them as vital to implementation of the proposed civil space program.

12. Safety, Reliability, Maintainability and Quality Assurance—$23,300,000

The Committee authorizes $23,300,000 for Safety, Reliability, Maintainability, and Quality Assurance. This is the same as the President's budget request and manifests the Committee's support of this critical element of NASA.

Summary of FY 1990 funding levels

Safety, reliability, maintainability, and quality assurance	$23,300,000
Total	23,300,000

The Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) program supports NASA's overall goals through activities in safety, reliability, quality assurance, maintainability, systems engineering, and program practices. It includes independent assessment activities which reduce program risk.

The SRM&QA program will continue to provide leadership to all operational, programmatic, and institutional activities of NASA. The key ingredient of this leadership is the continued integration of top level SRM&QA policies, procedures, and standards into each NASA program area. In the past year, key reliability requirements have been revised and expanded and deficiencies identified. Preferred techniques for implementing these new requirements will now be developed, and additional research will be initiated to develop the technology to eliminate the deficiencies. These techniques will ensure that the most current and effective methods in reliability engineering will be applied to all NASA programs, thus optimizing reliability, reducing risk, and enhancing mission effectiveness. The non-destructive evaluation (NDE) measurement assurance program will continue to provide state-of-the-art, quantitative, advanced inspection techniques for solid rocket motors, composites, and ceramics. The program will also explore advanced inspection techniques such as microfocus x-ray, fiber optics, acoustic emission, computer tomography, and laser thermography. The Systems Assessment program will continue to provide independent "second look" assessments of major Space Transportation System flight hardware issues.

Safety, Reliability, Maintainability, and Quality Assurance—Committee Comments

This authorization reflects the commitment of the Committee to this element of the NASA program and to the reestablishment of safety, reliability, maintainability and quality assurance as the hallmarks of NASA.

It has been nearly three years since the Office of Safety, Reliability, Maintainability, and Quality Assurance was established in the aftermath of the Challenger accident. While the Committee has been in contact with this Office, it has never asked it to issue a status report on NASA's efforts to reestablish safety and quality as the hallmarks of NASA. The Committee, therefore, requests the Associate Administrator of the Office of Safety, Reliability, Maintainability, and Quality Assurance to issue such a status report to the Committee by November 1, 1989.

13. Tracking and Data Advanced Systems—$19,900,000

The Committee authorizes $19,900,000 for Tracking and Data Advanced Systems in FY 1990. This is the same as the President's budget request.

Summary of FY 1990 funding levels

Tracking and data advanced systems	$19,900,000
Total	19,900,000

The Advanced Systems program is designed to study and develop new higher performance tracking and data handling capabilities which will address planned future mission requirements and will provide improved cost-effectiveness and reliability for overall support of the total mission mix. Advanced Systems programs continue to focus on assessing and employing technological advances in telecommunications, electronic microcircuitry, and computer sciences. Such effort is essential for the cost-effective application of new technology and for planning future mission support capabilities. Ongoing work includes the investigation of the total data transfer and processing needs of upcoming missions and studies of ground systems and telecommunications links to determine design approaches and overall tradeoffs for the lowest life cycle costs to support future space missions.

Future high-rate image data storage and processing requirements for Earth-orbital missions such as the Mission to Planet Earth's EOS are expected to increase from a current peak use of 85 megabits per second to 300 megabits per second in the Space Station era. These requirements result from high-resolution sensors, such as multispectral scanners and synthetic aperture radars, which will be transmitting more data than previous instruments. New techniques and systems will be studied and developed for the storage, processing, and transmission of these high data rates. These studies and developments include new techniques for signal coding and decoding, optical disk buffering and storage, automated distribution and processing of high volume data, improved man-machine interfaces, high speed modulators/demodulators, and a communications network using an optimal mix of fiber optics, satellites, and local area networks to distribute data to processing centers and users.

Investigations will continue on developing more efficient mission operations control center facilities and providing for the necessary real time interaction between the ground-based experimenters and their spaceborne experiments. Other investigations are being carried out in the area of expert system applications, greater use of distributed command terminals, and the performance of orbit and attitude computations onboard the spacecraft.

Tracking and Data Advanced Systems—Committee Comments

As noted previously in the discussion of information systems, projects such as the Space Station and the Mission to Planet Earth will dramatically increase the data processing, storage, networking, and dissemination requirements of NASA and other Federal agencies. Efforts to address these requirements and to develop the required technologies to assist in the effective utilization of this newfound wealth of data are critical elements of these programs and should be high NASA priorities. The Committee, therefore, strongly supports the Tracking and Data Advanced Systems program.

14. University Space Science and Technology Academic Programs—$35,000,000

The Committee authorizes $35,000,000 for the University Space Science and Technology Academic Programs in FY 1990. This is the same as the President's budget request and reflects the Committee's strong support of these academic programs.

Summary of FY 1990 funding levels

University affairs	$15,900,000
Minority university research	14,100,000
Space grant college and fellowship	5,000,000
Total	35,000,000

The University Affairs programs and the Minority University Research program together are proposed as a new budget line item this year in order to focus and enhance the resources and management devoted to university programs. FY 1990 funding will provide for continuation of agency-wide university and minority university programs which were previously budgeted in other NASA programs. As mandated in NASA's FY 1988 Authorization Act, funding is also provided for the National Space Grant College and Fellowship Program.

The goal of the NASA University Affairs program is to create and maintain strong and mutually productive working relationships with the Nation's university community. In order to accomplish this goal, the Office of External Relations and OSSA manage certain unique university programs that are agency-wide in scope and interest but are not within the direct responsibility of NASA program offices.

The specific objectives of the University Affairs program are:

(1) To significantly increase the number of highly trained scientists and engineers in aeronautics, space science, space applications, and space technology to meet the continuing needs of the national aerospace effort;

(2) To facilitate the direct interaction, further the professional knowledge, and stimulate the exchange of ideas between university faculty members and NASA scientists and engineers;

(3) To support innovative research at U.S. institutions of higher learning, research which is in the formulative or embryonic stage and which would appear to have significant potential to advance space science and applications programs; and

(4) To provide for the development and use of a core, long-term U.S. national university capability to conduct multiyear, Earth science discipline oriented applied research and remote sensing.

The goals of the NASA Minority University Research program are to continue to implement aggressively the initiative for Historically Black Colleges and Universities (HBCUs); develop closer relationships with minority universities other than HBCUs; maintain the Graduate Student Research program with an (underrepresented minority focus); and introduce an Undergraduate Researchers program with an (underrepresented minority focus). The Office of

Equal Opportunity Programs has the responsibility for the management of these programs.

NASA's HBCU initiative is mandated by Executive Order 12320 (issued September 1981) which requires Federal agencies to increase significantly the involvement of HBCUs in federally sponsored programs. NASA has implemented this initiative primarily through research and training grants. In FY 1990, NASA is proposing the establishment of HBCU Space Science and Engineering Centers of Excellence (SSECE) in order to be further responsive to the spirit of Executive Order 12320 and to help strengthen the research capabilities of selected HBCUs.

University Space Science and Technology Academic Programs—Committee Comments

The Committee is pleased to see a new line item in the FY 1990 NASA budget request for these academic programs and is hopeful that this visibility will enhance the base of support for these activities.

During the course of the last year, the Committee has worked closely with NASA to initiate the National Space Grant College and Fellowship Program. The Committee notes with interest that NASA has provided $900,000 in FY 1989 to initiate this program and that proposals for Space Grant Colleges/Consortia were submitted to NASA on or before June 30, 1989.

The Committee strongly endorses the National Space Grant College and Fellowship Program and the other NASA academic programs and notes the professional manner in which the NASA Office of Educational Affairs initiated the National Space Grant College and Fellowship Program. The Committee believes these programs are sound investments in the civil space program and in our Nation's youth. The Committee is encouraged by the progress NASA has made in this area during the last year and hopes to see these initiatives enhanced and expanded.

B. SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS—$5,104,600,000

The Committee authorizes $5,104,600,000 for Space Flight, Control and Data Communications activities in FY 1990. This is $35,000,000 less than the President's budget request. This reduction reflects a general reduction of $25,000,000 to the Space Tracking and Data Acquisition program and a general reduction of $10,000,000 to the Space Flight, Control and Data Communications account. These reductions are to be applied at the discretion of NASA, and the general reduction of $10,000,000 will affect the Committee's proposed funding for NASA's Space Flight, Control and Data Communications activities in FY 1990.

The objective of the NASA program of space flight, control and data communications is to provide for the operational activities of the Space Transportation System and tracking and communication system support to all NASA flight projects. The objective is achieved through the following elements:

Shuttle production and operational capability.—A program to provide a fully capable fleet of space shuttle orbiters, main engines, launch site and mission operations control requirements, spares inventory, production tooling, and related supporting activities.

Space transportation operations.—A program to provide the standard operational support services for the space shuttle and the ELVs. Within shuttle operations, external tank and solid rocket booster flight hardware is produced; operational spare hardware is provisioned, overhauled and repaired; and manpower, propellants, and other materials are furnished to conduct both flight and ground (launch and landing) operations.

Space and ground network, communications and data systems.—A program to provide vital tracking, telemetry, command, and data acquisition support to meet the requirements of all NASA flight projects using ground-based and satellite (Tracking and Data Relay Satellite System) components.

1. Space Shuttle Production and Operational Capability—$1,305,300,000

The Committee authorizes $1,305,300,000 for Space Shuttle Production and Operational Capability in FY 1990. This is the same as the President's budget request and reflects the Committee's strong desire to maintain the safety and reliability of the Nation's space transportation system. Of this level of funding (1) $121,300,000 is authorized only for the development of an advanced solid rocket motor (ASRM) and (2) such sums as may be necessary are authorized to ensure a safe, reliable space shuttle and an extended duration orbiter (EDO) capability.

Summary of FY 1990 funding levels

Orbiter operational capability	$237,000,000
Propulsion systems	727,300,000
Launch and mission support	341,000,000
Changes and systems upgrading	
Total	[1] 1,305,300,000

[1] This amount could be further reduced if NASA decides to apply any part of the $10,000,000 general reduction to the Space Flight, Control and Data Communications account to this line item.

Now that the space shuttle has safely returned to flight, the primary program objective of the current activity in the Space Transportation System is to conduct all future flights in a safe and reliable manner and to ensure the establishment of necessary capabilities to meet the manifested flight rate.

Shuttle Production and Operational Capability provides for the national fleet of shuttle orbiters, including the replacement orbiter, which was fully funded in FY 1987. This budget element also provides for equipment to outfit launch site and flight operations facilities, production tooling, development of an ASRM, and related support activities necessary to provide the capability to safely increase and sustain a shuttle flight rate up to 14 per year. Shuttle production also provides for the establishment of a logistics system, including an inventory of spare parts and assemblies, to support the operations flights at the 14 per year rate. The objectives of this program are to provide for the hardware and modifications needed to support the Space Transportation System flight manifest; the

completion of the national fleet of shuttle orbiters, including building a replacement orbiter for the Challenger; the development and production of an ASRM and other propulsion systems; development of launch site capabilities; and an EDO capability.

With the loss of Challenger in January 1986, the orbiter fleet was reduced to three vehicles pending delivery of a replacement orbiter. The current orbiter fleet includes Columbia, the orbiter developed and flown on four test and evaluation flights, and two orbiters of a lighter weight configuration, Discovery and Atlantis. The budget provides funding for necessary improvements, hardware fixes, and mission kits for the orbiter fleet to satisfy flight requirements. In addition, the Kennedy Space Center is managing the completion of the orbiter logistics capability and is continuing the procurement of spares needed to support the flight rate building. The EDO development is also included to increase on-orbit stay time in order to improve the shuttle capability to support payload requirements. Current planning is to explore potential sources of private financing for development of selected elements of this program.

Propulsion systems provide for the production of the Space Shuttle Main Engines (SSMEs), the development of the capability to support operational requirements established for the SSME, the solid rocket boosters (SRBs) and external tanks (ETs), and the development of an ASRM. The SSME program includes: production of main engines necessary for the orbiter fleet and a spares inventory; ground testing in support of engine development; anomaly resolution and product improvement; and advanced development efforts to improve operating margins. SRB production and capability development activities include: the reclamation of production verification and 51–L configuration solid propellant motors; investigation of returned flight hardware; procurement of tooling and equipment to support flight rate; and selected studies to continue investigative, analytical, and problem solving activities. With respect to the ASRM, in FY 1989 a contractor was selected to develop an ASRM for delivery in 1994. The program will include the design, development, test, and evaluation of the ASRM.

Launch and Mission Support provides for the required investment in Launch Operations and Flight Operations capability to meet Space Transportation System program objectives, which include supporting a safe flight rate. At the Kennedy Space Center, reactivation of launch pad A will complete a second time of facilities allowing simultaneous processing and checkout of orbiters and associated flight hardware from landing through launch. Additional facility and support equipment are being procured to sustain the flight rate capability. At the Johnson Space Center, mission support provides collateral hardware, principally the extra-vehicular maneuvering units (EMUs), while mission operations capability provides for improvements in the flight support systems. The flight support systems funded by this budget include training and carrier aircraft, additional landing aids and runway and barriers at the primary and contingency landing sites, and replacement/upgrade of equipment in the mission support complex including the Shuttle Mission Simulator and the Mission Control Center.

Space Shuttle Production and Operational Capability—Committee Comments

The return to flight of a safe, reliable space shuttle has been a long and arduous process and has been the result of the hard work and dedication of the NASA/contractor team. However, the real challenge for the space shuttle program still lies ahead, i.e. maintaining its safety and reliability and continuing to upgrade and increase the margin of safety and reliability of the space shuttle's components.

To assist in these activities, the Committee has fully funded the Space Shuttle Production and Operational Capability program in FY 1990. However, the Committee notes its concern that budget pressures have significantly depleted any reserves from this program area. The small reserve that does exist in FY 1990 is the result of the cancellation of a space shuttle flight. While the Committee agrees with NASA's decision in this matter and with the prioritization of safety/reliability over flight rate, it is concerned that an adequate resource base be available for sustained, testing, and upgrade activities.

To try to assist NASA in this regard and to ensure adequate funds for safety and reliability activities, the Committee has included language in the reported bill to permit NASA to use such sums as may be necessary from the amounts authorized for Space Shuttle Production and Operational Capability to ensure the safety and reliability of the space shuttle.

The Committee also has included language that permits NASA to use Space Shuttle Production and Operational Capability funds to ensure the availability of an EDO capability. The Committee is aware of ongoing efforts to obtain private sector financing for development of selected elements of this program. However, if these efforts are not successful, the Committee wants to be sure that this capability is developed. Based on an assessment of an EDO performed by NASA, it has been estimated that given access to a 28-day on-orbit capability, 85 percent of all materials sciences objectives could be satisfied. The Committee, therefore, endorses the current NASA EDO program and the proposed plan to achieve a 16-day mission by the end of 1992 and to evolve that capability beyond 16 days for later Spacelab missions.

Concerning the EDO, the Committee expects to be kept well advised of the findings and results of the EDO Medical Program and the requirements for an automated lander for EDO space shuttle missions.

The Committee also has earmarked $121,300,000 for development of an ASRM and believes this motor will enhance the safety and reliability of the space shuttle system. S. 663, which has already been reported by the Committee, provides the necessary authority to allow NASA to utilize private sector financing for the ASRM production facility and capital equipment.

2. Space Transportation Operations—$2,732,200,000

The Committee authorizes $2,732,200,000 for Space Transportation Operations in FY 1990. This is the same as the President's budget request and reflects the Committee's strong desire to main-

tain the safety and reliability of the Nation's space transportation system.

Summary of FY 1990 funding levels

Flight operations	$772,600,000
Flight hardware	1,236,500,000
Launch and landing operations	553,600,000
Shuttle operations	2,562,700,000
Expendable launch vehicles and services	169,500,000
Total	[1] 2,732,200,000

[1] This amount could be further reduced if NASA decides to apply any part of the $10,000,000 general reduction to the Space Flight, Control and Data Communications account to this line item.

The major program elements of Shuttle Operations are Flight Operations, Flight Hardware, and Launch and Landing Operations. These elements provide for the standard service operation of the shuttle, including preflight preparation activities, procurement and refurbishment of flight hardware, and maintenance and operation of equipment and facilities necessary to support all phases of the shuttle flight process.

The Flight Operations activity is divided into three major elements: mission support, integration, and support. Mission support includes training, flight operations activities, and a wide variety of planning activities ranging from operational concepts and techniques to detailed systems operational procedures and checklists. Integration includes launch support services and sustaining engineering for orbiter systems, cargo analytical integration, and systems integration. The support element includes systems support activity at the Johnson Space Center such as aircraft operations, engineering support, and support to the National Space Transportation System program office. Shuttle system support at Headquarters and the Marshall Space Flight Center and Stennis Space Center is also included.

The Flight Hardware program element provides for: the procurement of ETS and SRB elements including motors, booster hardware, and solid propellants; replenishment of spare parts inventory and repair of the reusable SSME, orbiter, and crew equipment; ET disconnects, logistics support for the orbiter ET and SRB, and SSME flight hardware elements; and maintenance and operations of flight crew equipment. Included in the funding request for tanks and boosters are the long lead time raw materials, subassemblies, subsystems, and additional ground testing of the redesigned solid rocket motor (SRM) necessary to sustain and verify the production of elements in a manner consistent with the flight rate requirements.

Launch and Landing Operations provides for the prelaunch preparation, liquid propellants, launch, and landing operations of the shuttle and its cargo.

In addition to being the primary launch vehicle for NASA missions, the shuttle provides launch support to approved payloads on a reimbursable basis. Because of the *Challenger* accident, however, there are currently $12.4 million in reimbursements in FY 1989 but no planned reimbursable funds for Shuttle Operations in FY 1990.

In this regard the ELV Mixed Fleet plan was initiated after the *Challenger* accident as a result of an assessment of NASA's space transportation requirements. This assessment showed that several U.S. civil government spacecraft should be launched on ELVs in order to provide increased access to space, to assure continuity of space operations, and to enhance mission flexibility. The missions currently planned for launch on ELVs are spacecraft requiring West Coast launches and selected East Coast launches which do not require the shuttle's unique capabilities and can transition to ELVs without significant impact to the spacecraft.

Space Transportation Operations—Committee Comments

The Committee believes that the operation of a safe, reliable transportation system has to be NASA's top priority. The Committee, therefore, has fully funded NASA's budget request.

As noted in the preceding section, the Committee endorses the prioritization of safety/reliability over flight rate and trusts that NASA will maintain these standards as it prepares to increase the space shuttle flight rate from four in FY 1989 to nine in FY 1990.

The Committee is pleased to see that the NASA Office of Space Flight has initiated a review of its ELV procurement process with industry and that NASA is committed to formulating a model contract and model request for proposals for commercial launch services. The Committee expects to be kept informed of NASA's progress and of any legislative requirements associated with this process.

The Committee also notes the Resources for the Future report "Launch Vouchers for Space Science Research." Elements of this concept could be applicable to the CCDS program payloads, as well as for space science research and JEA payloads. The Committee instructs NASA to assess this concept and to report its findings to the Committee by November 15, 1989.

Finally, the Committee is concerned about the status of the NASA/DOD Quid Pro Quo for launch services in light of the November 21, 1988, letter from the Air Force Director of Space and SDI programs, that indicated the Air Force was not able to provide a Titan IV. Since the Titan IV is the designated launch vehicle for the space station polar platforms, and CRAF and Cassini missions, and is a candidate for other NASA missions, the Committee feels strongly that there must be a concrete agreement between NASA and DOD concerning cost and availability of Titan IVs. The Committee directs NASA to submit a report to the Committee on this matter and the status of the Quid Pro Quo Agreement by November 15, 1989.

3. Space Tracking and Data Acquisition—$1,077,100,000

The Committee authorizes $1,077,100,000 for Space Tracking and Data Acquisition in FY 1990. This is $25,000,000 less than the President's budget request.

Summary of FY 1990 funding levels

Space network	$582,300,000
Ground network	269,600,000

Communications and data systems	250,200,000
Total	[1] 1,077,100,000

[1] This total reflects a general reduction of $25,000,000 in FY 1990 to be applied at NASA's discretion. This total could be further reduced if NASA decides to apply any part of the $10,000,000 general reduction to the Space Flight, Control and Data Communications account to this line item.

The purpose of the Space Tracking and Data Acquisition program is to provide vital tracking, telemetry, command, data acquisition, communications, and data processing support to meet the requirements of all NASA flight projects. In addition to NASA flight projects, support is provided on a reimbursable basis for projects of DOD, other government agencies, commercial firms, and other countries and international organizations. Support is provided for Earth orbital, planetary, and solar system exploration spacecraft missions, launch vehicles, research aircraft, sounding rockets, and balloons.

Tracking and acquisition of data for the space projects is presently accomplished through the use of a worldwide network of NASA ground stations and by two tracking and data relay satellites in geosynchronous orbit working with a highly specialized ground station. Ground facilities are interconnected by terrestrial and satellite communications circuits linking the spacecraft and their control centers for execution of the missions.

NASA has three basic support capabilities to meet the needs of all classes of NASA flight missions. These are the Spaceflight Tracking and Data Network (STDN), which currently supports Earth orbital missions; the Deep Space Network (DSN), which primarily supports planetary and interplanetary flight missions; and the Space Network, including the Tracking and Data Relay Satellite System (TDRSS), which will provide most low Earth orbital mission support when it becomes fully operational.

Highly specialized computation facilities provide real-time information for mission control and accommodate processing into meaningful form the large amounts of scientific, applications, and engineering data which are collected from flight projects. In addition, instrumentation facilities provide support for sounding rocket and balloon launchings and flight testing of aeronautical research aircraft.

The Space Flight, Control and Data Communications request includes the Space Network, STDN, DSN, and Communications and Data Systems elements of the program and provides funding for: (a) TDRSS operations, spacecraft production, and launch support; (b) operations and maintenance of the tracking, data acquisition, mission control, data processing, and communications facilities; (c) the engineering services and procurement of equipment to sustain and modify the various systems to support continuing, new, and changing flight project support requirements; and (d) the spectrum management, frequency allocation, and flight data standards support functions for NASA.

Space Tracking and Data Acquisition—Committee Comments

In this account, the Committee was required to make a general reduction from the President's request to provide funds for other

priority activiities. The Committee believes this reduction can be made with minimum impact to the tracking and data acquisition program.

The Committee notes the successful launch and deployment of two Tracking and Data Relay Satellites by the space shuttle since last September. The successful deployment of this system provides a critical element of the Nation's space transportation and space research capability.

Also the Committee would like to indicate that it generally endorses the NASA proposal to modify the existing TDRSS contract with Contel, provided that the final contract improves management interfaces and reduces the overall program costs.

C. CONSTRUCTION OF FACILITIES—$341,800,000

The Committee authorizes $341,800,000 for Construction of Facilities in FY 1990. This is the same as the President's budget request.

Summary of FY 1990 funding levels

1. Construction of addition for Space Systems Automated Integration and Assembly Facility, Johnson Space Center	$10,500,000
2. Construction of addition to Mission Control Center, Johnson Space Center	17,800,000
3. Construction of addition to Simulator/Training Facility, Johnson Space Center	3,800,000
4. Modifications for Expanded Solar Simulation, Johnson Space Center	2,000,000
5. Modifications of Process Technology Facility for Space Station, Marshall Space Flight Center	4,000,000
6. Replacement of Cooling Towers, Launch Complex 39 Utility Annex, Kennedy Space Center	4,600,000
7. Replacement of Launch Complex 39, Pad A Chillers and Controls, Kennedy Space Center	1,200,000
8. Replacement of Roofs, Launch Complex 39, Kennedy Space Center	11,000,000
9. Replacement of Vehicle Assembly Building Air Handling Units, Kennedy Space Center	1,800,000
10. Upgrading of Orbiter Modification and Refurbishment Facility to Orbiter Processing Facility 3, Kennedy Space Center	26,000,000
11. Modifications of High Pressure Industrial Water System, Stennis Space Center	2,000,000
12. Replacement of High Pressure Gas Storage Vessels, Stennis Space Center	3,000,000
13. Construction of natural resource protection at various locations.	3,800,000
14. Refurbishment of bridges, Merritt Island, Kennedy Space Center	4,500,000
15. Rehabilitation of Spacecraft Assembly and Encapsulation Facility II, Kennedy Space Center	3,500,000
16. Rehabilitation of Central Heating/Cooling Plant, Johnson Space Center	2,800,000
17. Construction of Data Operations Facility, Goddard Space Flight Center	12,000,000
18. Construction of Quality Assurance and Detector Development Laboratory, Goddard Space Flight System	7,500,000
19. Modernization of South Utility Systems, Jet Propulsion Laboratory	5,400,000
20. Construction of 40 × 80 Drive Motor Roof, Ames Research Center	1,000,000
21. Modifications to Thermo-Physics Facilities, Ames Research Center	4,600,000
22. Modifications to 14 × 22 Subsonic Wind Tunnel, Langley Research Center	1,000,000

23. Modifications to National Transonic Facility for Productivity, Langley Research Center	7,600,000
24. Modifications to 20-Foot Vertical Spin Tunnel, Langley Research Center	1,900,000
25. Rehabilitation of Central Air Systems, Lewis Research Center	2,400,000
26. Rehabilitation of Central Refrigeration Equipment, Lewis Research Center	7,200,000
27. Rehabilitation of 8 × 6 Supersonic and 9 × 15 Low-Speed Wind Tunnels, Lewis Research Center	6,800,000
28. Rehabilitation of Hypersonic Tunnel, Plum Brook	4,100,000
29. Repair and Modernization of the 12-Foot Pressure Wind Tunnel, Ames Research Center	27,600,000
30. Construction of Automation Sciences Research Facility, Ames Research Center	10,600,000
31. Construction of Supersonic/Hypersonic Low Disturbance Tunnel, Langley Research Center	6,900,000
32. Modifications for Seismic Safety, Goldstone, California, Jet Propulsion Laboratory	2,600,000
33. Repair of facilities at various locations, not in excess of $750,000 per project	28,000,000
34. Rehabilitation and modification of facilities at various locations, not in excess of $750,000 per project	36,000,000
35. Minor construction of new facilities and additions to existing facilities at various locations, not in excess of $500,000 per project	10,000,000
36. Environmental compliance and restoration	30,000,000
37. Facility planning and design not otherwise provided for	26,300,000
Total	341,800,000

The Construction of Facilities authorization provides contractual services for the repair, rehabilitation, and modification of existing facilities; the construction of new facilities and the acquisition of related facility equipment; environmental compliance activities; the design of facilities projects; and advanced planning related to future facilities needs. The funds requested for FY 1990 provide for continuing prior year endeavors to meet facilities requirements for the SSF and Space Flight Programs; construction of new facilities needed to support science, space technology, and aeronautical research; continuation of the multi-year effort to restore and modernize NASA's aeronautical research and development facilities; repair, rehabilitation, and modification of other facilities to maintain, upgrade, and improve the usefulness of the NASA physical plant; minor construction of new facilities; facility planning and design activities; and environmental compliance and restoration.

The projects and amounts in the budget estimates reflect SSF and Space Flight requirements that are time-sensitive to meet specific program objectives. Other program requirements for FY 1990 include refurbishing bridges at Merritt Island, rehabilitation of the Spacecraft Assembly and Encapsulation Facility II at the Kennedy Space Center, rehabilitation of the central heating/cooling plant at the Johnson Space Center, construction of a Data Operations Facility and a Quality Assurance and Detector Development Laboratory at the Goddard Space Flight Center, modernization of the south utility systems at the Jet Propulsion Laboratory, projects to repair, restore, and modernize NASA's aeronautical research and development facilities at Ames, Lewis, and Langley Research Centers, and at the Plum Brook Station, construction of an Automation Sciences Research Facility at the Ames Research Center, construction of a Supersonic/Hypersonic Low Disturbance Tunnel at the Langley Re-

search Center, and modifications for seismic safety, at Goldstone, California.

The FY 1990 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and ensuring safe, economical, and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program begun in prior years and continues a repair program. The repair program restores facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements. The environmental compliance and restoration program ensures that statutory environmental requirements are met and any necessary remedial action promptly taken.

In addition to the above, four projects are proposed for private sector financing. These projects are the ASRM production and test facility, Yellow Creek, Mississippi, the Space Station Processing Facility at the Kennedy Space Center, the Neutral Buoyancy Laboratory at the Johnson Space Center, and the Observational Instruments Laboratory at the Jet Propulsion Laboratory. The projects selected for privatization are functionally suitable for processing, developing, or manufacturing commercial space products as well as directly supporting NASA programs. Economic analyses show that privatization is cost-beneficial to the Government, provided the proposer retains 20 percent or more ownership of the facilities. It also precludes large outlays by the Government in FY 1990 and FY 1991.

Construction of Facilities—Committee Comments

This authorization reflects the Committee's belief that facilities are an integral component of the civil space program. For too long, there has been an emphasis on research and development funding at the expense of facilities and personnel funds.

As noted in the subsequent discussion of privately financed facilities in section 105 of the bill, the Committee has reservations about private sector financing of facilities. If such initiatives actually were to result in cost savings or expansion of the market for space services as a general matter, the Committee would look more favorably at this financing concept. However, the Committee has yet to see hard evidence of such an impact.

D. RESEARCH AND PROGRAM MANAGEMENT—$2,032,200,000

The Committee authorizes $2,032,200,000 for Research and Program Management in FY 1990. This is the same as the President's budget request and reflects the Committee's strong support of NASA's personnel.

Summary of FY 1990 funding levels

Personnel and related costs	$1,222,040,000
Travel	50,957,000
Operation of installation	759,203,000
Facilities services	(305,468,000)
Technical services	(195,671,000)

Management and operations	(258,064,000)
Total	2,032,200,000

The Research and Program Management authorization funds the performance and management of research, technology and test activities at NASA installations, and the planning, management, and support of contractor research and development tasks necessary to meet the Nation's ongoing objectives in aeronautical and space research. The objectives of the activities funded by the Research and Program Management appropriation are (1) to provide a civil service staff with the technical and management skills to conduct the full range of programs for which NASA is responsible; (2) to provide base maintenance of facilities in support of research and development programs; and (3) to provide effective and efficient technical and administrative support for the research and development programs.

During the summer of FY 1988, NASA conducted an in-depth review of its manpower requirements. The results of the study indicated that based on Space Station program needs as well as Research and Technology base requirements, NASA would need a significant increase to its current work force. In discussions with OMB relative to the results of the manpower review, OMB agreed that NASA's full-time equivalent (FTE) ceilings be increased in FY 1989 to 23,734 and to 24,007 in FY 1990. Current budget levels will not allow NASA to meet OMB approved higher ceilings, and thus this budget is predicated on NASA's ability to fund FTE levels of 23,150 in FY 1989 and 23,846 in FY 1990, including the Inspector General's Office. NASA remains committed to achieving OMB approved ceilings for both FY 1989 and FY 1990. Every possible effort will be made to secure funding so that planned programmatic activities can be realized.

The FY 1990 Research and Program Management appropriation request provides funding for 23,700 permanent and temporary civil service FTE personnel, exclusive of the Inspector General's Office, at eight major installations and Headquarters. This civil service work force is NASA's most important resource and is vital to future space and aeronautics research activities. Approximately six percent of the requested funding provides for the salaries and related costs of the civil service work force. Two and one-half percent is for travel, critical to the successful management of the agency's in-house and contracted programs. The remaining amount of the Research and Program Management authorization provides support for the research, test, and operational facility support, and for related goods and services necessary to operate efficiently and effectively the NASA installations and to accomplish NASA's approved missions.

Research and Program Management—Committee Comments

A consistent theme at this year's NASA hearings was the concern over NASA's ability to attract and retain qualified personnel. The combined effect of current Federal pay levels and the enactment of the new ethics standards has worsened this situation and has had a serious impact on NASA personnel. Senior NASA man-

agers are retiring to avoid complications with the new ethics requirements, and junior NASA managers are going to industry where comparable jobs pay 50–100 percent more per year.

The Committee is seriously concerned about this problem and wants NASA to know that it will work actively with the agency and the Administration to resolve this situation. NASA's personnel are the agency's most precious resource, and the Committee believes more must be done to acknowledge and reward its dedicated civil service work force.

E. INSPECTOR GENERAL—$8,795,000

The Committee authorizes $8,795,000 for the Office of Inspector General (OIG) in FY 1990. This is the same as the President's budget request and reflects the Committee's strong support of the NASA Inspector General's Office.

The NASA OIG, established by the Inspector General Act of 1978 (Public Law 95–452), performs a balanced program of audits and investigations to assist NASA management in promoting economy, efficiency, and effectiveness in the administration of its programs and operations, and to prevent and detect fraud and mismanagement. With over 88 percent of the agency's total obligations allocated to procurement, a significant amount of OIG activity is directed toward contract fraud and procurement irregularities. OIG auditors and investigators conduct independent audits and investigations of NASA's programs and operations. The OIG works jointly with other Offices of Inspector General, the Federal Bureau of Investigation (FBI), the Defense Contract Audit Agency (DCAA), and other audit and investigative entities when concurrent jurisdiction exists.

The Inspector General (IG) and senior OIG managers have been active in a number of ways to promote the IG concept. The IG participates as a member of the Department of Commerce Computer System Security and Privacy Advisory Board (CSSPAB), speaks to NASA's senior executives and mid-level managers at the Senior Executive Program and Management Education Program sessions and internal management groups, and makes keynote addresses and presentations to professional organizations. Other senior OIG managers also have participated in various projects for the President's Council on Integrity and Efficiency (PCIE), in professional association committees, in intergovernmental forums, and in meetings and conferences, and have given presentations to professional organizations.

The OIG has continued to maintain a strong Congressional liaison in responding to specific requests and providing information on matters of interest to Committees. Matters having agency or office-related legislative impact have been reviewed and commented upon. During this reporting period, no serious or flagrant problems, abuses, or deficiencies relating to NASA's programs and operations were identified that required reporting under the provisions of Public Law 95–452, section 5(d).

In this reporting period, the Inspector General Act Amendments of 1988, Public Law 100–504, was enacted, which provides for revised reporting requirements of audit results and a separate appro-

priations account for the OIG. This authorization bill assumes implementation of the new audit reporting requirements to the extent practicable. However, DCAA statistics will continue to be reported under DCAA reporting requirements.

Inspector General—Committee Comments

During the course of the last five years, the Committee has established a close working relationship with the OIG and has used this Office to investigate some very sensitive matters. In each instance, the OIG has handled these matters with dispatch and resolve and in a very professional manner. The Committee looks forward to maintaining this relationship.

Sector 105

This section amends the National Aeronautics and Space Act of 1958 to give NASA the authority to enter into contracts, leases or agreements providing for private financing of three NASA facilities—the Space Station Processing Facility at the Kennedy Space Center, the Neutral Buoyancy Facility at the Johnson Space Center, and the Observational Instrument Laboratory at the Jet Propulsion Laboratory.

As was the case with the proposed private financing of the ASRM Production Facility, NASA requires legislative authority to be able to provide the necessary contingent liability/termination liability to ensure investor confidence in the private financing of such facilities. This language provides that authority and permits NASA to use its unobligated funds as collateral in case the Government terminates a contract for its convenience.

Based on its review of these and other private financing proposals contained in the President's FY 1990 NASA Authorization bill, the Committee became concerned that there were no clear standards by which to assess such private offerings. The Committee, therefore, asked the Congressional Budget Office (CBO) to assess the seven commercialization proposals that were contained in the NASA budget request. That CBO Staff Memorandum, "Preliminary Analysis of NASA Commercialization Initiatives," stated that:

> * * * if the lease or service contract arrangement is to be less expensive to the government than direct procurement, the government will have to share the use and cost of the facilities or hardware with other customers. An example would be a space station facility that the government uses fully during the deployment—thus, a smaller, lower-capacity alternative would not do—but thereafter shares with another user. For the government to realize cost saving from private financing, the lower "principal" payments permitted by sharing with a non-U.S. Government user must be sufficient to offset the higher interest cost of borrowing at the private, as opposed to the government, rate.

Based on its analysis of the Administration's private financing proposals, the Committee has decided that it will assess each proposal on a case-by-case basis. The Committee, therefore, has not

given NASA generic authority for such proposals as requested in the Administration's proposed FY 1990 NASA Authorization bill. In light of some reservations about the value and benefits of private sector financing, the Committee has established three standards that must be met by the three facilities that are addressed in this section before the use of such financing is authorized.

First, the Administrator of NASA must determine that the privately financed facility is in the best interest of the Government.

Second, the Administrator of NASA must determine that the privately financed facility will result in net cost savings to the Government.

Third, no project considered for private financing shall be initiated unless the Administration (NASA) has submitted to the Committee a notice of intent to initiate the project, along with a description of the project, and thirty days have passed after each submission.

As noted above, the Government's financial obligations under such contracts, leases, or agreements would be limited to amounts provided in advance in appropriations Acts.

Section 106

This section instructs NASA to distribute its research and development funds on a geographical basis where possible. The Committee has annually legislated this requirement, believing it is in the national interest.

Section 107

This section reiterates the past Committee position that the space station may be used only for peaceful purposes. This language is consistent with existing U.S. treaty obligations (the Outer Space Treaty) and current law—Public Law 100-685.

Section 108

This section allows the Administrator of NASA to utilize up to five percent of the funds provided for the Small Business Innovation Research Program for program management and promotional activities. None of these funds may be used for travel or civil servant salaries. This would make NASA's implementation of the program consistent with other Federal agencies and ideally would result in more commercial spinoffs and applications.

Presently, NASA is not allowed to use any of the Small Business Innovative Research Program funds for administrative, program management, or promotional activities. During its review of the Program, the Committee was advised that this constraint, which was upheld by the Comptroller General in decision B-217925 of July 29, 1985 (64 Comp. Gen. 711), severely constrains the program and the dissemination of its technical findings. The Committee was advised by the program office that a small set-aside for program management and promotional activities such as proposal review costs, support contract costs, automated data processing costs, and outreach activities costs could assist the program and heighten the commercial potential of the innovative research being performed by small businesses.

Section 109

This section indicates that it is the sense of the Congress that the current prohibition on the export of U.S.-built satellites to the Soviet Union for launch on rockets of the Soviet Union shall continue to be the policy of the United States and that the policy shall be expanded to prohibit the export of U.S.-built satellites to other nations for launch on rockets of the Soviet Union.

TITLE II

Section 201—Office of Commercial Space Transportation

Section 201 of the bill amends section 24 of the Commercial Space Launch Act (49 U.S.C. 2623) to provide $4,392,000 for FY 1990 for the Office of Commercial Space Transportation (OCST) of DOT. This conforms to the President's request, will enable OCST to fulfill responsibilities pursuant to the Commercial Space Launch Act, and will ensure that OCST meets projected demand in FY 1990 from entities seeking a DOT license to launch commercial ELVs.

OCST was established pursuant to Public Law 98-575, with the specific purpose of establishing and enforcing the licensing and regulatory regime necessary for commercial space transportation operations. These activities include safety research and planning and licensing procedures.

To date, OCST has issued three commercial launch licenses and currently has under review and in process six commercial launch applications. The Office anticipates that 20 more requests for licensing actions will be received before the end of the calendar year.

To review properly and thoroughly these applications, the Committee supports the FY 1990 budget request and the efforts of the Office to augment its staff with people with engineering and technical backgrounds.

Adequate resources to oversee and regulate properly the commercial ELV industry is essential to ensure that the United States can fulfill its obligations under international treaties, as well as to protect fully the health and safety of the public.

The Committee notes the role of the OCST in the effort to formulate model government contracts and requests for proposals for launch services on domestic ELVs. The Committee supports these efforts.

The Committee also notes the report submitted by the Secretary of DOT concerning "A Study of the Scheduling of Commercial Launch Operations at National Ranges." This report raises a variety of issues and concerns that the Committee intends to address as it assesses the viability and marketability of domestic ELVs.

TITLE III

Section 301—National Space Council authorization

Section 301 of the bill authorizes $1,200,000 for the activities of the National Space Council in FY 1990. The Council was established pursuant to section 501 of the National Aeronautics and Space Administration Authorization Act, Fiscal Year 1989 (42

U.S.C. 2471). The Committee has reviewed this authorization with the Council and OMB and believes the prescribed level of funding is adequate for FY 1990.

The Committee notes that the proposed level of funding in FY 1990 would provide for a 50 percent reimbursement for any Executive Branch employee detailed to the National Space Council. Concerning detailees, the Committee also notes that in establishing the Council, it did not envisage a prominent role for detailees. The Committee saw the Council as "lean and mean" with a professional staff of not more than seven people as required by section 501(C) of Public Law 100-685—the FY 1989 NASA Authorization Act. Detailees were seen as "temporary" staff who would bring a specific expertise to the Council for a limited period of time—not permanent employees who would head up directorates. The Committee wants to remind the Council of this intent and will continue to work with Council on improving its effectiveness.

Changes in Existing Law

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new material is printed in italic, existing law in which no change is proposed is shown in roman):

National Aeronautics and Space Act of 1958

Title III of that Act

Sec. 301 through Sec. 311 * * *

PRIVATELY FINANCED FACILITY PROJECTS

Sec. 312. Notwithstanding the provisions of any other law, the Administration is authorized to enter into contracts, leases, or agreements providing for private financing of the Space Station Processing Facility at the Kennedy Space Center, the Neutral Buoyancy Laboratory at the Johnson Space Center, and the Observational Instrument Laboratory at the Jet Propulsion Laboratory for the use of the Administration, its contractors, or its subcontractors, except that—

(1) such authorization may not be utilized unless the Administrator determines that such privately financed construction or modification is in the best interest of the Government and results in net cost savings to the Government;

(2) no project considered for private financing shall be initiated unless the Administration has submitted to the Committee on Commerce, Science, and Transportation of the Senate, the Committee on Science, Space, and Technology of the House of Representatives, and the Committees on Appropriations of the Senate and House of Representatives a notice of intent to initiate the project, along with a description of the project, and thirty days have passed after such submission; and

(3) if, pursuant to this section, the Administrator authorizes privately financed construction or modification, the Administration is authorized, notwithstanding any provision of law to

the contrary, to assume in the resulting contract, lease, or agreement contingent liability in excess of available appropriations relating to the Government's potential termination for its convenience of such contract, lease, or agreement, if such contract, lease, or agreement limits the amount of the payments that the Federal Government is allowed to make under such contract, lease, or agreeement to amounts to be provided in advance in appropriations Acts.

COMMERCIAL SPACE LAUNCH ACT

Section 24 of that Act

[AUTHORIZED APPROPRIATIONS

[SEC. 24. There are authorized to be appropriated to the Secretary $4,000,0000 for fiscal year 1985. There is authorized to be appropriated to the Secretary to carry out this Act $586,000 for fiscal year 1986. There is authorized to be appropriated to the Secretary to carry out this Act $4,548,000 for fiscal year 1988. There is authorized to be appropriated to the Secretary to carry out this Act $3,827,000 for fiscal year 1989.]

AUTHORIZED APPROPRIATIONS

SEC. 24. There is authorized to be appropriated to the Secretary to carry out this Act $4,392,000 for fiscal year 1990. Sums appropriated for research and development shall remain available until expended.

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